Manual for ANIMAL HEALTH AUXILIARY PERSONNEL

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS ROME

MANUAL

for

ANIMAL HEALTH AUXILIARY PERSONNEL

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PREFACE

This Manual is aimed at providing animal health auxiliary personnel in the Veterinary Departments of developing countries, especially those in tropical regions, with a simply worded, well-illustrated text covering animal health and associated subjects.

The title "Animal Health Auxiliary" (A.H.A.) has been used in accordance with the recommendation made at the Third Meeting of the FAO/WHO Expert Panel on Veterinary Education, held in Rome in 1971. The term covers all personnel having no professional qualifications, but who perform technical duties in Veterinary Departments in support of professional staff.

Animal health auxiliary staff form a great and vitally important body of workers on whom, in most developing countries, the small number of professional Veterinarians are largely dependent for the notification of the presence of disease and for the implementation of the necessary control and preventive measures.

Furthermore, some countries, and particularly those deficient in numbers of Veterinarians, often have to call upon their animal health auxiliary staff to diagnose, treat and control diseases to an extent not considered advisable in other countries and are obliged to give them, and perhaps stockowners too, access to drugs and equipment which elsewhere would be available only to professional veterinary personnel.

It is appreciated that some countries already have excellent manuals available which meet the needs of their own particular environmental conditions. Such countries may also provide a standard of local training for their A.H.As which enables them readily to comprehend and envisage the parts, functions and organs of the animal body and the diseases that are dealt with in this Manual.

Other countries, however, not only lack manuals of their own, but are able to give their animal health auxiliary staff only limited training.

Against this background of a diversity of conditions and needs, it has not always been easy to decide what subjects should be included in this Manual and how far it should go in covering the subjects selected for inclusion. The approach, therefore, in its compilation, has been to cover the whole subject in as practical a way as possible, to provide sound scientific explanations in as simple a language as possible and, above all, to keep in mind continuously the nature of the duties in the field in developing countries involved in maintaining the health and productivity of animals at a high level and in helping to solve the problems of the stockowners.

It is hoped, therefore, that this Manual will be helpful to animal health auxiliary personnel of those developing countries not having manuals specifically written to suit their own particular needs or who wish to improve their course training and technical reference material for their auxiliary staff working in the field.

R. B. Griffiths
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ACKNOWLEDGEMENTS

In the preparation of this Manual, the contributions made by Dr. D.E. Faulkner, who compiled the material and completed the text, and by Mr. G. Beccaloni, who was responsible for all the line drawings, must be especially acknowledged.

Special mention is made of the valuable contribution of Dr. I. Mann, Kenya, who kindly agreed to the reproduction as Part 6 of "Slaughter of Animals and Preparation of Hides and Skins for the Market", which was originally included in a text (now out of print) published in Kenya in 1951.

Valuable suggestions for the improvement of the text were made by Mr. R.M. Arnold, Mr. H.P. Harding and Mr. P.D.L. Guilbride, former FAO staff members, who were asked to review and comment on the Manual at an early stage of its preparation.

Members of the Animal Health Service of the FAO Animal Production and Health Division reviewed those parts of the text concerned with their areas of specialization and made valuable suggestions for their improvement.

The services of Dr. J. Wegener, Veterinary Education Officer, Animal Health Service, who was responsible for the administrative arrangements for the Manual and who provided much valuable assistance in the final stages of its preparation, must also be mentioned.

Finally, it must be stated that a great number of text books, documents and published manuals from various countries were consulted during the compilation and preparation of the Manual. These, however, are too numerous to name here individually, but a general acknowledgement must be made of the great value of this wealth of material in the compilation of this Manual.

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STRUCTURE, FUNCTIONS AND ORGAN SYSTEMS OF THE ANIMAL BODY

and

MANAGEMENT OF LIVESTOCK TO ENSURE GOOD HEALTH AND MAXIMUM PRODUCTIVITY

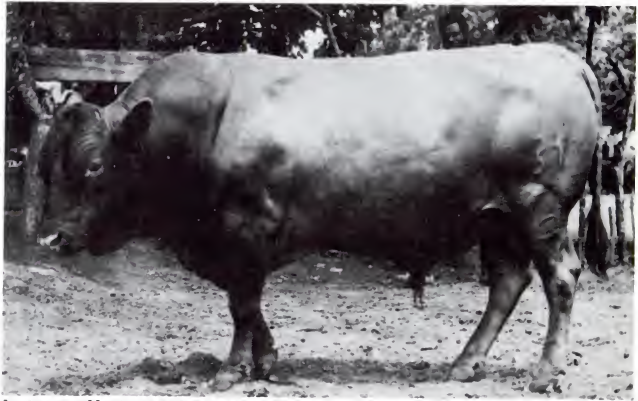


Fig. 1 An excellent example of an African indigenous breed with high potential for development - the N'Dama of West Africa. Exceedingly well adapted to local environmental conditions and having a high degree of tolerance to trypanosomes and resistance to streptothricosis (Dermatophilosis).

CHAPTER 1

STRUCTURE, FUNCTIONS AND ORGAN SYSTEMS OF THE ANIMAL BODY

General
(Section 1)

Those who refer to this Manual will be concerned mainly with domestic ruminants, that is cattle, sheep, goats and camels, and to a lesser extent with single stomached animals such as the pig, the horse, and the donkey.

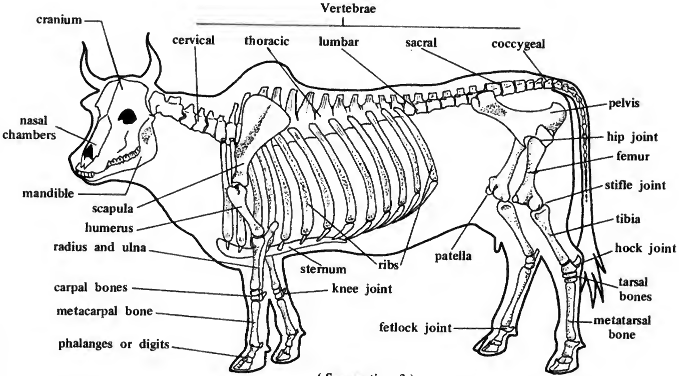
The cow and the ox will, therefore, be the animals mainly used in describing the structure and fuctions of the animal body. The main differences between them and other species such as the sheep, goat and pig, will be mentioned as the various organs and parts are described.

The Animal Body as a Whole
(Section 2)

The animal body as a whole is made up of millions of cells which have all developed from one cell by a process of division during which they gradually become more specialized. The specialized cells group together to form the various tissues of the body such as bone, muscle, nerve etc. From these tissues different organs are formed.

The organs are the well defined parts of the body of the animal which perform particular functions.

Fig 2 - THE SKELETON OF CATTLE SHOWING THE BONES



(See section 3)

Groups of organs having a particular common function are referred to as organ systems. These organ systems will be described under eight headings as follows:

Skeletal system	(Sec. 3)
Muscular system	(Sec. 4)
Digestive system	(Sec. 5)
Respiratory system	(Sec. 6)
Circulatory system	(Sec. 7)
Nervous system	(Sec. 8)
Urogenital system	(Sec. 9)
Special systems	(Sec. 10)

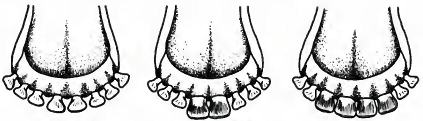
The Skeletal System
(Section 3)

Bones are the unit organs of the skeleton or skeletal system of animals which, with cartilage and teeth, give form and shape to the body and attachments for muscles.

The head and skull, consisting of many bones, are followed by the spine or vertebral column which runs down the whole length of the body in a line linking up the other parts of the skeleton.

The vertebral column consists of five groups of bones named cervical (along the neck), thoracic (above the chest), lumbar and sacral (along the back) and coccygeal (down the tail). The chest or thorax is made up of the ribs (of which there are 13 pairs in cattle) and the breast bone.

Fig 3 - THE ERUPTION OF TEETH IN ZEBU CATTLE

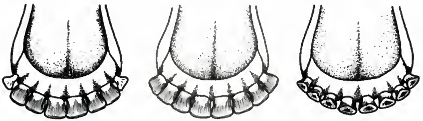


under 2 years

2 years 3 months

3 years

The small teeth are the temporary or milk teeth which fall out. The large teeth are the permanent incisors.



3 years 6 months

about 4 years old
(4 pairs of permanent incisors)

old animal, 4 pairs of permanent incisors in wear.

The teeth of exotic and improved breeds erupt slightly earlier but considerable variation occurs between all breeds and types of cattle of the same ages.

(See section 3)

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The rest of the skeleton consists of the bones and joints of the forelimb, which include the shoulder blade or scapula, and the bones and joints of the hind limbs.

The teeth, of vital importance for mastication or chewing, are the means by which the age of animals is usually estimated. They consist of incisor teeth, in the front; the canine or tusk at the side, and the molar teeth at the back.

In cattle there are no incisor or canine teeth on the upper jaw and the canine teeth of the lower jaw are modified to assume the shape and function of incisors.

All animals have a temporary set of teeth including, what are termed premolars (in front of the main set of molars which erupt later).

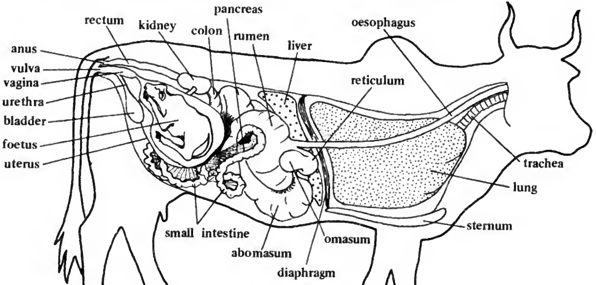
The number of teeth of cattle, sheep and pigs are as follows:

Cattle and sheep	20 temporary
	32 permanent
Pigs	32 temporary
	44 permanent

The age of cattle and sheep (teeth are rarely used to age pigs) is estimated from the incisor teeth only, the teeth erupting as follows:

	Permanent Incisors	
	Cattle	Sheep+Goats
1st Pair	1.5 - 2 yrs.	1 - 2 yrs.
2nd Pair	2 - 2.5 yrs.	2 - 2.5 yrs.
3rd Pair	3 - 3.5 yrs.	3 yrs.
4th Pair	About 4 yrs.	4 yrs.

Fig 4 - THE INTERNAL ORGANS OF THE COW (RIGHT SIDE)



(See section 5 & 6)

The teeth of cattle of the exotic breeds erupt earlier than those of indigenous zebu breeds.

Signs of wear appear on teeth about 3 months after their eruption.

The Muscular System

(Section 4)

This system consists of many separate muscles each representing a unit organ of the system and the active organ of movement. It is of great economic importance in meat-producing animals. Muscles more or less cover the skeleton except the bones of the lower limbs which are covered by tendons and skin.

Usually, but not always, the muscles become stiff after death, a condition termed rigor mortis.

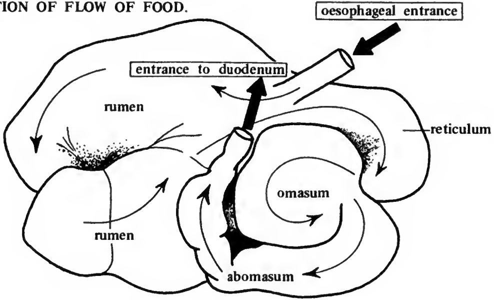
The Digestive System

(Section 5)

(i) Organs

The alimentary canal is a long irregular tube some 54m long looped on itself many times and widening and contracting along its course. It starts at the mouth and continues as: the throat or pharynx; the gullet or oesophagus; the stomach, which, in the ruminant, has four compartments (the rumen or paunch; the reticulum or honeycomb; the omasum or book and the abomasum or "true" stomach). The pig, horse and donkey have only one stomach and this functions in much the same way as the "true" stomach of the ruminant.

Fig 5 - STOMACHS OF THE RUMINANT (FROM RIGHT SIDE) SHOWING DIRECTION OF FLOW OF FOOD.



(See section 5)

The alimentary canal continues on from the stomach as the small intestine (some 40 m long) and the large intestine, which includes the caecum, colon and rectum, and finally to the anus.

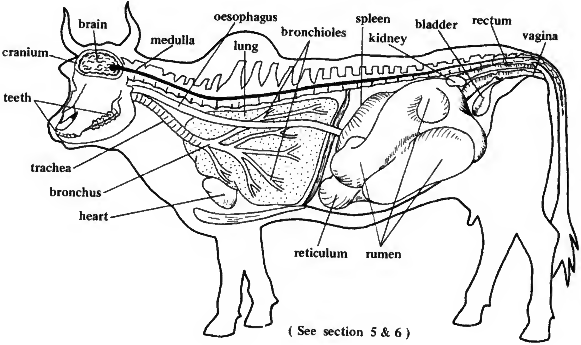
The internal surfaces of the canal are protected and lubricated by mucous membranes which also secrete gastric juices. The serous membranes line and protect all the cavities of the body, and lubricate and separate the abdominal organs.

(ii) Digestion

Before the feed can be used by the animal it must be digested. In the ruminant this is preceded by a period during which the animal takes in a large quantity of feed (such as grass bitten off by its incisor teeth) which is swallowed, without chewing, and temporarily stored in the rumen. In the rumen and reticulum this material is broken down by micro-organisms. When the animal is at rest it regurgitates this feed in small quantities back into the mouth where it is chewed ("chewing the cud" or "ruminating") and mixed with saliva.

Depending on the fineness of the particles in this now semi-solid food it then passes down through the reticulum and the omasum into the "true" stomach and the small intestines, where micro-organisms and secretions of gastric intestinal glands and other glands (such as the pancreas) break down the complex nutrient substances of the feed (protein, carbohydrates and fats) into simpler substances which can be absorbed through the stomach and intestinal walls and be taken in by the body.

Fig 6 - THE INTERNAL ORGANS OF THE COW (LEFT SIDE)



(See section 5 & 6)

The digested food is absorbed into the blood by small vessels, the capillaries. The capillaries collect the nutrients from the true stomach and the small intestines in much the same way as the hair roots of plants collect food from the soil.

Digestion continues in the small intestine and in the first part of the large intestine, the caecum. After the caecum, what is left of the food passes into the colon, where it loses most of its water, and then into the rectum where it is now in the form of faeces or dung and in this form it passes out of the anus.

Zebu cattle appear to be able to digest roughages more efficiently than the European breeds while the buffalo has the reputation of being able to digest coarse roughage feeds better than cattle.

(iii) Liver and Pancreas

Two large glandular organs also involved in the digestive process are the liver and the pancreas.

The liver acts as a filter to the blood and a store for nutrients in the form of a sugar (glycogen) which is delivered into the blood stream as required by the body.

The liver is indirectly connected to the small intestine by the bile duct, originating from the gall bladder, which is attached to the back of the liver. The bile is a by-product of liver activity and is discharged down the bile duct into the small intestine where it enters into the digestion process. If, because of disease, the bile duct becomes blocked, a condition known as jaundice occurs in which the tissues of the body become yellow; this is most easily observed in the white membranes of the eye. The pancreas produces digestive juices which like the bile are discharged into the small intestine.

(iv) Dangers in the System of Rumination

Because coarse feeds are first swallowed by the animal without being chewed, pieces of metal or wire accidentally swallowed in the feed may pass into the rumen. These may even penetrate the wall of the rumen and into the sac (pericardium) surrounding the heart. In such cases an operation carried out by a veterinarian may save the animal's life.

It must also be remembered that the ruminant is unable to vomit so even if it swallows poison it is unable to get rid of it as a single stomach animal can.

The Respiratory System

(Section 6)

(i) Organs

The organs of this system, in the order as they are used, are: the nasal cavity; the pharynx (or cross roads); the larynx (or voice box); the trachea (or wind pipe); the bronchi (or tubes) and the lungs (or lights) which are made up of numerous very small air sacs. A small piece of cartilage (the epiglottis) automatically closes the entrance to the larynx and trachea when the animal swallows so that feed and water pass directly down the oesophagus and into the rumen.

(ii) Respiration and Expiration

The lungs are the essential organs of breathing. The chief functions of breathing are: to supply oxygen which is used or "burnt"

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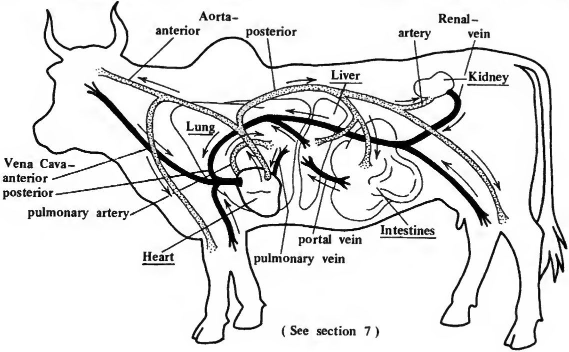
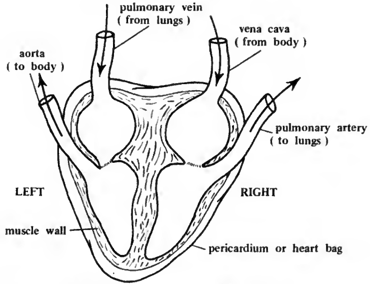
Fig 7 - CIRCULATION AND BLOOD VESSELS

▨ Arteries carry blood FROM the heart. ▬ Veins carry blood TO the heart.



(See section 7)

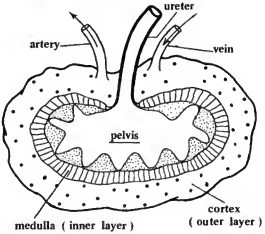
Fig 8 - THE HEART



The heart has two chambers on each side, with the Auricles on top and the Ventricles below.

(See section 7)

Fig 9 - THE KIDNEY



URETERS carry the urine from the kidneys to the bladder.

(See section 7)

in the body to release energy, and to remove carbon dioxide (the result of the "burning") from the body.

The other parts of this system act as passages for the air used in breathing. The upper respiratory part of the system warms, moistens and filters the inhaled air on its way to the lungs.

Inhalation or inspiration of air into the lungs and expiration or expulsion of air from the lungs are brought about mainly by the contraction or relaxation of the diaphragm, a large muscle dividing the chest from the stomach and abdominal cavity.

The number of respirations per minute varies in different animals (see Appendix 4). The lungs, trachea and oesophagus, with the heart are usually taken out of a carcase as one piece and are then referred to as the "pluck".

The Circulatory System
(Section 7)

Organs

The organs of the circulatory system are: the heart and the vessels of the system; the arteries and arterioles; the capillaries and the veins and venules.

The heart is a muscular organ which works like a powerful pump, pumping blood to all parts of the body. Each of the two sides (which do not commnunicate with each other) have an upper and lower chamber or cavity. Both sides contract at the same time. Blood from the left side is pumped into the arterial system through a large vessel, the aorta.

The Pulse

The "pulse" is the intermittent wave in the arteries caused by the contraction and dilatation of the heart as it pumps (see Section 110 for taking the pulse of animals and Appendix 4 for the pulse rates of different animals).

Arteries carry the blood from the heart and aorta. They become smaller and smaller until they become arterioles.

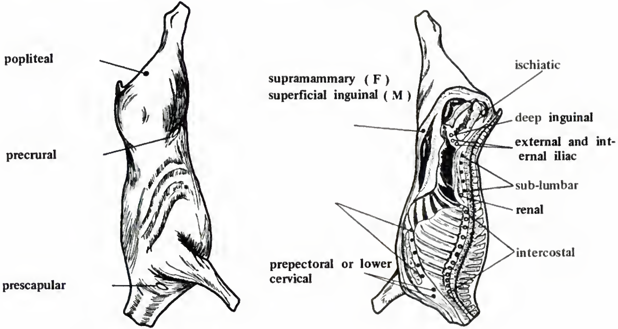
Venules and veins bring the blood back to the heart.

The Lymphatic System

The lymphatic system is part of the circulatory system and acts as the "middleman" between the blood and tissues in feeding the body. The vessels of this system (the lymphatics) collect the lymph a colourless fluid coming from the fluid part of the blood through the vessel walls and pass it back to the veins through a system of lymph nodes which filter bacteria (including harmful bacteria) from it. In meat inspection the lymph nodes provide a useful indication of the presence of disease which might be harmful to human consumers of the meat.

The following are some of the important lymph nodes:

Fig 10 - THE MOST IMPORTANT LYMPH NODES OF THE ANIMAL BODY.



Outside view of carcass

Inside view of carcass

(See section 7)

Under the skin (in the live animal these can be felt, especially if they are enlarged)

Submaxillary - one on each side of throat under mandible
Parotid - at base of ear·
Prescapular - in front of scapula
Precrural - in front of stifle-joint
Supra-mammary - above and behind udder

Deeper in the body

Mesenteric - in thin skin supporting intestines
Bronchial - near entry of bronchi into lungs
Mediastinal - attached to the membrane (mediastinum) between the two lungs
Popliteal - deep in the rear of the thigh muscle

The spleen is an important organ of the lymphatic system; many diseases can be diagnosed from smears taken from the spleen.

The Blood

The circulatory system is the vitally important system which transports the blood to and from the millions of cells making up the body. The blood in its passage round the body picks up oxygen from the air in the lungs and nutrients derived from the food in the intestines and takes these to the cells throughout the body. It brings back to the lungs carbon dioxide formed in the tissues which is expelled into the air.

The blood also carries other waste materials formed during body processes (termed metabolism) to the liver for processing, to the kidneys for filtration and excretion in the urine and to the skin for removal in the sweat.

Blood is a red fluid made up of red and white blood cells (or corpuscles) and other cells in a fluid referred to as blood plasma. The plasma makes up more than half of the blood. When blood clots the cells and other material come together to form a firm jelly-like mass or clot, the fluid part being called serum. The red cells are given their colour by a substance haemoglobin which contains iron. Iron is, therefore, very important in animal life.

In the lungs the haemoglobin of the blood combines with oxygen. When it reaches the tissues it releases the oxygen, the red cells then becoming dark and bluish. This is why venous blood is darker than arterial blood.

Red blood cells have a short life but are constantly being formed in blood forming organs such as bone marrow.

There are several kinds of white cells in blood. These are much less numerous than the red cells and are mainly formed in the lymph nodes.

The white cells are of great importance because they are able to engulf and ingest micro-organisms and thus help to protect the body against disease. They are also important because differences in the proportion of the different cells help in the diagnosis of disease.

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Other valuable functions which blood performs include the regulation and distribution of the body temperature (see Section 109 on taking an animal's temperature) and the transport of hormones from the glands to organs to regulate their function.

The Nervous System
(Section 8)

The nervous system can be considered under three headings:

(i) the central nervous system which includes the brain and the spinal cord which passes down through the bones of the vertebral column;

(ii) the peripheral nervous system which consists of nerves distributed throughout the various organs of the body including the special organs of sight, smell and hearing;

(iii) the sympathetic or autonomic nervous system which consists of nerves distributed to the soft organs of the large body cavities, blood vessels and sweat glands. This system governs the involuntary activities of the body (i.e. those not subject to the will of the animal).

These three systems are all interconnected and are really parts of one large system.

The nervous system is responsible for the direction, coordination and control of all the activities of the body.

The skin, which has many nerve endings, is very important to the central nervous system. It is described in Section 10.

Urogenital System and Reproduction
(Section 9)

(i) Urinary System

The urinary system consists of 2 kidneys, 2 ureters, the bladder and the urethra.

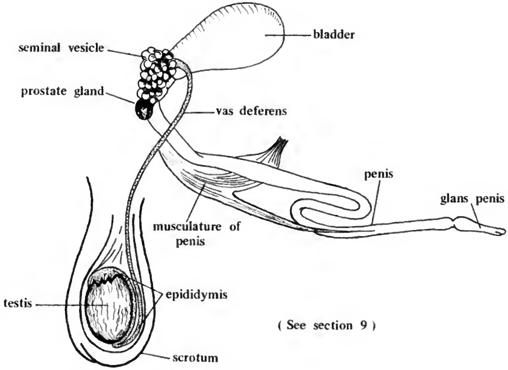
These organs are responsible for the production of urine (from the kidneys); its conveyance (down the ureters); its storage (in the bladder) and its emission (from the urethra).

The secretion of urine is a process by which water and certain waste substances are filtered from the blood as it passes through the kidneys.

Only in the case of the urethra do differences exist between males and females in the urinary system. In the female the urethra is short, opening onto the floor of the vagina while in the male it is contained in the body of the penis.

(ii) Genital Organs of Male

The testicles, situated in the scrotum, produce sperm for reproduction. The vas deferens in the spermatic cord is the tube along which the sperm travels from the testicle into the urethra near the bladder.



(See section 9)

Fig 11 - THE REPRODUCTIVE ORGANS OF A BULL

A testicle is sometimes retained in the abdomen and does not enter the scrotum. In such a case the animal is referred to as a "rigg".

Male animals are castrated (removal of the testicles) in order to prevent them reproducing and to make them more docile and easier to handle. A castrated male also tends to have a bigger frame, important in meat production. Various methods of castration are described in Section 128.

Castrated males in the case of bulls are referred to as "bullocks" or "steers".

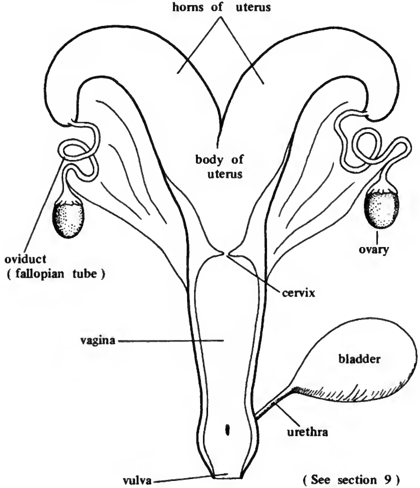
In America the word "hog" is generally used instead of "pig" to cover all types of animals of this species.

(iii) Genital Organs of the Female

The organs of the female consist of the ovaries, situated high up in the abdominal cavity; the fallopian tubes or oviducts down which the ovum (egg) moves to the uterus or womb, which is in the form of two horns joining together to form a short body; the cervix at the end of the body forming the entrance to the uterus; the vagina a short passage from the cervix to the vulva, which is also a short passage way and the lips of which are outside the body just below the anus.

The mammary glands (or udder) which secrete milk for the young are on the lower part of the abdomen. In the cow, sheep, camel and buffalo they consist of 4 glands each with a teat. The number of glands in other animals

Fig 12 - THE REPRODUCTIVE ORGANS OF THE COW.



(See section 9)

corresponds roughly to the usual number of young born at a time by the animal concerned.

(iv) Reproduction

Oestrus is the period when the female is "on heat" or "in season". Over this period it will willingly mate with a male. The period of oestrus occurs during the oestrous cycle, the period (in non-pregnant animals) from the beginning of one heat period to the beginning of the next.

The oestrous cycle varies in length in different animals as does the heat period. The average age of puberty (when the animal becomes sexually active), the length of the oestrous cycle and the period of oestrus (heat) in different animals, are as follows:

	Puberty (months)	Length of Oestrous Cycle (days)	Oestrus (Heat Period) (Hours/days)
Cow Buffalo	10-20 (15)	18 - 24 (21)	(4 - 24) 18 hours
Ewe	8-12 (9)	17	1 - 2 days
Sow	5-9 (7)	21	1 - 3 days

However, these figures vary considerably with breed, climate and the level of nutrition.

The cow and sow breed regularly throughout the year but the ewe breeds only during a breeding season the oestrous cycle occurring only during that season.

The signs of oestrus (heat) especially in the cow include bellowing; the cow mounting or being mounted by another; restlessness; a swollen vulva, a colourless mucous discharge from the vulva and the cow standing for other cows to mount her.

"Silent heat" is when the signs of oestrus are so slight that they fail to be recognized. This seems to be particularly common in the buffalo. One of the main causes of silent heat is when animals are passing through a period when their nutrition is at a low level.

The presence of a male in the herd will usually reveal when females are in 'silent heat'.

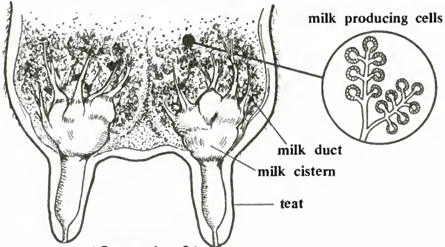
(v) Pregnancy

The ovum (1 or sometimes 2 in the cow) is formed in follicles (clusters of special cells) in the ovary and towards the end of oestrus is discharged into the fallopian tube.

When a male mates with the female, he deposits his ejaculate into the vagina. The millions of sperms in each ejaculate swim around in the fluids then present in the female. Some sperm pass through the cervix, which at this time is open, some penetrating along the uterus to the fallopian tube.

An ovum will be fertilized by only one sperm. This fertilized ovum (embryo) becomes attached to the wall of one of the horns of the

Fig 13 - THE UDDER OF THE COW AND BUFFALO SHOWING TWO OF THE FOUR GLANDS.



(See section 9)

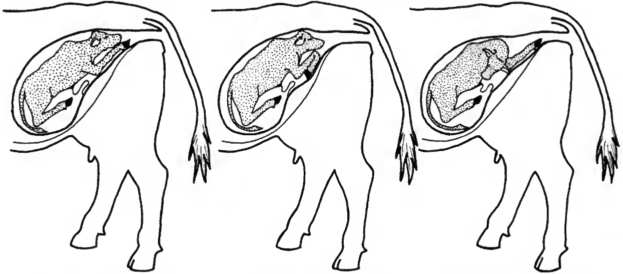
uterus. Here the embryo develops a sac containing fluid (the foetal membranes) toprotect it. This gradually develops and is later called a foetus. The foetus, surrounded by its foetal membranes (called the placenta), develops into a young animal which at birth is expelled from the uterus through the cervix into the vagina and out through the vulva.

The foetal membranes are attached to the wall of the uterus by numerous cotyledons or "buttons" through which the developing foetus obtains its nutrition from the blood supply of its dam through its umbilical cord (navel cord). After the birth of the young, the placenta is referred to as the "after-birth" and this is expelled after the calf.

The signs of pregnancy include the stopping of the oestrous cycle; the animal becoming quieter and often improving in condition; and if the animal is lactating, diminution of milk production. The abdomen later increases in size and later still the udder enlarges. Finally colostral milk will be secreted and wax formed at the end of the teats.

The duration of pregnancy varies greatly in different species and different animals of the same species. The average periods of gestation in different animals are as shown in the table below: (see also Appendix 6).

Fig 14 - THE POSITION OF THE FOETAL CALF IN LATE GESTATION.



1. Correct position of foetus, (forelegs and muzzle correctly placed)

2. Incorrect position of foetus, (showing forelegs bent back)

(See section 9 v & vi)

3. Incorrect position of foetus, (showing head twisted back)

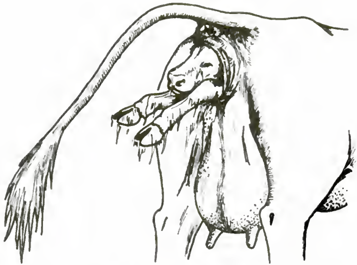


Fig 15 - The correct presentation of the calf at birth with front feet and muzzle appearing first. (See section 9 vi)

Species	Average Length (days)	Normal Range (days)
Cow	280	274 - 291
Buffalo - swamp	332	312 - 343
- river	-	308 - 317
Ewe	150	140 - 160
Sow	113	110 - 116

(vi) Parturition

In the normal position in the cow the foetus faces towards the back of the cow with its front legs extending towards the vulva and with its nose between the two legs. Sometimes it may have its hind legs directed towards the vulva.

If the feet and head are showing at the vulva the cow may sometimes need help and this can be given by gently pulling the feet outwards and downwards. If there are obvious difficulties and abnormalities a veterinarian should be called if possible. If the Animal Health Auxiliary (A.H.A.) cannot contact his Veterinarian, he must use his judgement as to whether he intervenes. If he intervenes he must remember that it may be better to let nature take its course since intervention involves risks of damage to calf or dam and the risks of infection.

The umbilical cord (navel cord), through which the young animal has received its nutrition from the dam, breaks at birth, the small part left on the young animal drying up and falling off soon after birth.

Twins in the cow may cause difficulties but in the ewe twins are common and rarely cause trouble.

After the birth of the young the "afterbirth" may often be seen outside the cow hanging down from the lips of the vulva. Gently pulling on it may successfully detach it from the uterus; this should be done within 24 hours of delivery.

(vii) Colostral Milk

Under Section 9 (v) the secretion of colostrum was referred to. This is the milk which is secreted by the cow for the first few days after parturition. It is very important that this milk is taken by the calf. It contains twice as much protein (vital for the growing animal) than does ordinary milk as well as immunizing bodies and vitamins which protect the young animal from disease. It also has a laxative effect. The substances in the colostrum soon disappear from the milk after parturition.
It is very important, therefore, that the young animal receives colostral milk during the first four days of its life.

Special Systems
(Section 10)

(i) General

The special systems include the sense organs (the eyes, ears, nose and senses of taste and smell), these being of particular importance to animals. the protective system which includes the skin, horns, hair and hooves and the endocrine organs.

The sense organs and the protective system are closely associated with the nervous system, the nervous system being the main messenger service of the animal's body transmitting impulses or messages to the different organs.

(ii) The Skin

The skin, the protective covering of the body, is as important to the central nervous system as the eyes, ears, or the taste buds on the tongue. It has many nerve endings and these are responsible for the sensations of pain, heat and cold.

All livestock except goats, rabbits and fowl have sweat glands in the skin and this is especially the case in horses and to a lesser extent in sheep.

Sweating helps to regulate the temperature of the body by evaporation.

Cattle, buffalo and pigs sweat mainly from the muzzle but the buffalo and the pig prefer to wallow in mud or water if they get too hot.

The skins of cattle and buffaloes are referred to as hides while in the case of sheep and goats the word skin is used. Hides and skins are the most valuable by-product of animals slaughtered for food. The hide of the buffalo is very thick.

(iii) Hair, Hooves and Horns

Hair, hooves and horns are modifications of skin. Unless the hooves of ruminants are kept trimmed they easily overgrow which leads to malformation of the feet, inability to walk and reduced milk yield in the case of milking cows and buffaloes.

Horns are frequently prevented from growing when the animal is young by removing the "horn bud" stage of growth or are cut off in older cattle. The horns of buffaloes vary greatly in size, shape and direction. Often they are flat, long or short and curled and sometimes carried far back. The various methods of dehorning are described in Section 126.

(iv) The Endocrine Glands

The endocrine glands produce secretions which travel in the blood stream all over the body. The secretions are called "hormones", the activities of these being very complicated. They are particularly important in regulating the reproductive process.

The hormones function according to the glands from which they originate. These include the thyroid, thymus, pituitary, adrenal, and parathyroid glands, and the pancreas, ovaries, and testicles.

The functions of the various hormones include the development of the male characteristics, the initiation of milk "let down" in the milking cow, the regulation of the oestrus cycle, milk secretion, libido and others. The Veterinarian uses these hormones in injection form quite frequently and especially in connection with reproductive problems.

CHAPTER 2

MANAGEMENT OF LIVESTOCK TO ENSURE GOOD HEALTH AND MAXIMUM PRODUCTIVITY

Essential Elements of Good Health

(Section 11)

The previous chapter gave some indication of how the body of the animal works and functions and what it needs to do this. Balanced feed, pure water and air are essential elements. For optimum health and maximum productivity, however, other things are needed including good grazing and, in the case of animals kept under intensive conditions (e.g. intensive dairy production), supplementary feeding, suitable, well ventilated buildings, adequate exercise, periods out in the sunshine, good bedding (if kept inside), clean and hygienic surroundings and freedom from contact with disease.

If kept under tropical conditions with high temperatures, high producing, exotic breeds of cattle of temperate country origin (such as Friesians) can be provided with fans and regularly put through shower sprays to keep them cool.

Ensuring that the animal has these things, varying in accordance with the environmental conditions and the purpose for which it is kept, is what is meant by good livestock management and good animal husbandry.

As was stressed in the Introduction, the main aim of those concerned with livestock must be to prevent disease and maintain at a high level (and, if possible, improve) the health of the animals for which they are responsible.

The previous chapter dealt with the general functions of the animal body and its parts. Now, the appearance and characteristics of the normal, healthy animal will be described.

In addition the important factors in livestock management and animal husbandry to which attention must be paid to ensure that the animal is kept in that condition, will be discussed.

Appearance of a Healthy Animal

(Section 12)

In its general appearance the healthy animal is alert, active, well aware of its surroundings and, when walking, walks easily and with regular steps.

Its eyes are bright, wide open and with no sign of discharge at the corners. Its ears are erect (in most breeds), move quickly to counter flies and towards unusual sounds.

Its tail is also in continuous movement against flies.

Its coat is smooth and shiny, particularly so in the case of the short haired coats of Zebu and African indigenous breeds. In some regions certain breeds will grow a long rough winter coat but this is not the dull "staring coat" of the sick animal or animal in ill-health.

In the standing position the healthy animal will stand evenly on its four feet in a relaxed position with its back level.

In this position breathing will be smooth, regular and unhurried with a respiration rate of 10-30 per minute. Exercise will of course increase the rate and in certain diseases the animal will also breathe more quickly.

The heart normally beats at from 40-60 beats per minute and this can be heard from the heart itself or felt from the animal's pulse rate (see Section 110 for taking an animal's pulse and Appendix 4 for the pulse rates of different animals).

The storage of feed in the rumen prior to it being brought up and chewed ("rumination" or "chewing the cud") was explained in Section 5. In a healthy animal this process involves the regular and steady squeezing of the chewed forage and feed and mixing them with fluid. The contractions can be felt high up on the left side ("flank") of the animal in the hollow behind the short ribs.

Factors for Optimum Health and Maximum Productivity

(Section 13)

(i) General

The requirements of animals for optimum health and, for their breed and type, a high level of productivity were mentioned in Section 11.

Good livestock management and good animal husbandry will ensure this and must, therefore, always be practised.

The most important factor in good livestock management and good animal husbandry is the provision of a high level of feeding for the animal whether it be kept intensively (e.g. for high dairy production) or extensively on grazing lands or range areas.

(ii) Feeds and Feeding (including watering)

(a) Composition of Feeds

Feed for an animal should be sufficient in quantity and of good quality.

Vegetable matter consists of carbohydrates, protein, fat, minerals, and vitamins (these are termed nutrients) and water and fibre. Fibre has feeding value only to ruminants but also provides 'bulk' to a feed.

Animals take up feed to extract the carbohydrates, protein, fat, minerals and vitamins from it. Additional salt and special minerals may sometimes be required.

A feed of high feeding value is one high in nutrients. A feed of low feeding value is said to be low in nutrients.

Carbohydrate is the nutrient which supplies animals with heat and energy. Grain crops such as maize, sorghum, wheat, oats, etc. contain from 65-75 percent carbohydrate.

Protein formed in the plants consists of a number of "essential" amino-acids which are the basis of all living matter. The animal's body uses it to build up all the soft parts of its body and for many hormones and enzymes.

In many developing countries cattle have to contend with long periods of grazing during the dry season. It is during this time that the grass is deficient in protein, which results in slow growth and muscular development and reduced production including wool and hair.

Ruminants are able to overcome protein deficiency to some extent because micro-organisms present in the rumen are able, themselves, to provide protein.

Leguminous plants such as alfalfa (lucerne) are valuable because they have 15-25 percent of protein as well as varying amounts of minerals and vitamins.

Plants also contain fat. Cotton seed, groundnuts and sunflower seed contain from 20-40 percent of fat.

Animals store fat in their bodies and this, if necessary, can be changed back into carbohydrate and water to supply them with heat and energy.

The minerals required by animals are those collected by the plants from the soils. These are used in the animal's body to build up bones, brain and nerves. If soils and plants are deficient in certain minerals such as calcium, phosphorus and copper, signs of ill-health may appear.

Vitamins occur in plants in minute quantities. Some vitamins can be produced in the rumen. They are essential to health and life but they do not supply heat or energy to the body as does carbohydrate.

Feeds usually available generally provide the necessary amounts of vitamins required by the animal's body. However, in countries where animals are dependent for long periods on dry season grazing, animals may suffer from a deficiency of vitamins A and E.

When animals are housed for long periods and not given well balanced rations they also may suffer from deficiencies of vitamins.

(b) Types of Feeds

Animal feeds can be divided into two kinds, roughages and concentrates.

Roughages consist of bulky feeds which contain low percentages of nutrients, examples of such feeds being poor grass or hay, silage and maize stalks, root crops, sweet potato tops, sweet potatoes and silage. The last four are known as succulent feeds and are more easily digested.

Concentrates are feedstuffs high in nutriments and include the grain crops and residues from the industrial processing of grains and other feedstuffs for human consumption.

Ruminants, because of their large 4 compartment stomachs, are able to live mainly on roughage but animals with a single stomach need some concentrates.

(c) Rations

A "daily ration" is the correct amount of feed to give an animal every 24 hours. For the best results it should be "balanced", that is, it should contain the correct proportions of carbohydrates, protein, fat, minerals and vitamins for the type of animal being fed.

Fattening steers, for example, need a greater proportion of carbohydrates and fats than milking cows which need more protein.

Because maize alone has too much carbohydrate and too little protein; because legumes have too much protein and not enough carbohydrates and because crops such as groundnuts, cotton seed and sunflowers have too high a percentage of fat, they are not "balanced". It can be seen, therefore, that to produce a balanced ration feeds must be mixed. An example of a balanced ration would be: 3 parts maize, 1 part sunflowers and 1 part unshelled groundnuts or cotton seed. Green grass in the growing season is also a balanced feed since when it is growing it has a high feeding value.

As grass gets older its feeding value decreases and "supplementary" feeds then become necessary.

Working oxen will do well on grass when it is growing but in the dry season they should be given supplementary hay or silage (10-20 kg).

Dairy cows in milk should be given 0.5 kg of concentrates for every 1.5-2 kg of milk they produce.

In the dry season high producing milking cows should always be given plenty of grass, with hay, 5-10 kg of silage or other succulent feed and a full ration of concentrates.

Young stock should be fed plenty of hay in the dry season in addition to grazing and, if available, a ration of succulent feeds.

In arid areas and areas in which, during the dry season grazing becomes scarce and the vegetation low in feeding value, supplementary feeds such as hay, silage or concentrates should, if possible, be given, otherwise the animals will lose condition and become thin. The same occurs when animals are overworked and no supplementary feed is given.

Minerals likely to be deficient as a result of poor feed and grazing can be given in the form of a "lick". A good lick can be made up of 2 parts bonemeal, 1 part rock phosphate (which should be analyzed to ensure its freedom from fluorine) and 2 parts common salt. In some areas addition of small amounts of "trace elements" as determined by the Laboratory may be desirable.

(d) Deficiency Conditions

Conditons of ill-health and disease resulting from deficiencies of protein, minerals or vitamins will be dealt with under the diseases and conditions affecting the various species of animals included in Part 2 of this Manual. It must be remembered, however, that the deficiency most commonly encountered in many developing countries is that resulting from an overall lack of feed. In many countries it is this which is the greatest cause of mortality and loss in livestock.

(e) Do's and Dont's in Feeding

Changes of the ingredients of rations or increases in their quantity should always be effected slowly. For example, if changing from dry to green feed, animals should be given increasing amounts of green feed over 4-7 days because if suddenly introduced to a high proportion of succulent green feed, they may become bloated (see Section 77).

Animals should never be able to eat or pick up musty or mouldy feed or old bones (this can cause disease) and feeding troughs should always be kept clean with no old feed being left in them.

(f) Watering

Animals should have access to plenty of clean, pure water to drink - at least 3 times daily if possible.

Watering places should be kept clean and located far from human lavatories otherwise cattle may become infected with "measles" (see Section 74).

Animals should be watered before being given feed otherwise they may become "bloated".

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A cow not in milk requires 25-35 litres (5-7 gallons) of water a day but if it is milking an additional 20 litres of water for each 5 litres of milk she produces, should be given.

(iii) The Grazing Animal

The majority of livestock in developing countries depend for their feed on natural grassland and vegetation. Such grassland and vegetation are usually grazed on extensive rangelands communally used and with no systematic management being practiced.

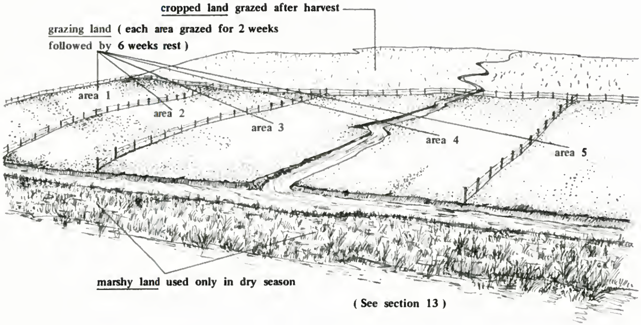
Grazing lands are often over-stocked and over-grazed and the animals are forced to travel long distances in search of grazing and water.

Grasses cannot stand up to continuous grazing or cutting. They must have periods of rest so that they can develop their root systems, build up food reserves and form seed. They must be able to do this otherwise they will die.

Selective grazing of the more palatable grasses must also be prevented since this weakens them and allows the coarse, poorer grasses to spread and dominate the grazing. Under-grazing of grasslands is as bad as overgrazing since in this case also it allows the more vigorous, but less desirable plants, to smother the good grasses.

Rotation of Grazing Areas. The best way of avoiding the ill-effects of over-grazing and selective grazing is to divide up the grazing land so that the animals graze only on a part of

Fig 16 - ROTATION OF GRAZING AREAS.


cropped land grazed after harvest
grazing land (each area grazed for 2 weeks followed by 6 weeks rest)
area 1
area 2
area 3
area 4
area 5
marshy land used only in dry season

(See section 13)

it at a time (which may be varied from one season to another depending upon the rainfall and growth of grass), the other part being allowed to rest and grow unhampered.

Rotational or deferred grazing control, as it is called, is also of considerable value in controlling the spread of parasitic infection resulting from eggs dropped by infested animals on the grasslands. However, such grazing control requires either demarcation of the grazing areas, herding of animals and good organization or the use of fences or hedges which are expensive to plant and maintain.

Special care should always be taken to avoid concentrating young animals on improved pastures near boreholes or around dairies as these quickly become heavily infested with parasites.

Other practices which should be followed in order to ensure that animals on grazing lands and range areas are adequately fed during periods of shortage of feed include the making and conservation of hay or silage even from the natural grassland. Such hay or silage should be cut during the growing season when it is at its high level of nutrition.

One further characteristic of open rangelands sometimes having ill-effects on grazing animals can be the lack of trees for the protection of the animals against the sun. High producing, exotic animals from temperate countries are adversely affected by such conditions. On the other hand Zebu and indigenous African cattle can withstand such conditions well, although they too benefit from shade in the hot season.

PART 2

DISEASE OF ANIMALS AND ITS CONTROL - GENERAL PRINCIPLES

CHAPTER 3

DISEASE - GENERAL PRINCIPLES

What it is and its Causes

(Section 14)

Disease, in a general sense, can be said to be a deviation from the normal conditions of an animal. It can also be said to mean a change in the normal condition of an animal caused by a living organism and this is the meaning more generally given to it.

Diseases caused by living organisms are called infectious and all of them can be spread from animal to animal. Those transmitted by direct or indirect contact are sometimes called contagious. Diseases spread by insects or other vectors are called non-contagious.

The living organisms which may invade the body and cause disease include:

(i) Bacteria

These are small organisms from the vegetable kingdom generally visible under the ordinary microscope and termed cocci (round or oval in shape); bacilli (rod shaped) or spirilla (long cells twisted into spirals). Examples of the diseases they cause are anthrax and blackquarter. Bacteria also include organisms called rickettsia which (like viruses) can multiply only in living cells. Two important rickettsial diseases, anaplasmosis and heartwater - very common in tropical countries - are transmitted by ticks and are, therefore, included in the "tick-borne diseases" which are caused by protozoa (see (iii)).

(ii) Viruses

These are so small they can only be seen under a special, very high-powered microscope. Examples of the diseases they cause are rinderpest, African swine fever and foot-and-mouth disease. Viruses can be transmitted by small flying insects, examples of the diseases caused in this way are blue tongue and three day sickness.

(iii) Protozoa

These organisms which belong to the animal kingdom, are normally larger than bacteria and can clearly be seen under the ordinary microscope.

An important difference between protozoa and bacteria is that in the case of many of the diseases caused by protozoa, the protozoan organisms concerned undergo part of their reproductive cycle in an intermediate host such as a tick or fly. These diseases are of special importance in tropical and sub-tropical areas.

Examples of protozoan diseases caused in this way and of great importance to animals are the tick-borne diseases such as East Coast fever, redwater and tick fever (transmitted by the progeny of ticks) and nagana (animal trypanosomiasis) transmitted through the tsetse fly.

Some diseases caused by protozoa have no intermediate host such as the ticks or tsetse flies mentioned above but are passed directly or indirectly (by mechanical carriers) to a final host (e.g. coccidia, Trypanosoma equiperdum and T. evansi).

Protozoan diseases are considered in this Manual in three groups:

(a) The tick borne diseases (including the rickettsial diseases, anaplasmosis and heartwater which are transmitted by ticks).

(b) Diseases caused by trypanosomes carried by flies, and

(c) Diseases due to coccidia.

(iv) Parasites

This is a very important group of organisms from the animal kingdom which live (or are parasitic) in or on other organisms or animals which are referred to as the "hosts".

These parasitic organisms are referred to as ecto-parasites when they live on the outside of animals (ticks, mites, fleas and lice) and endo-parasites when they live inside the animal (flukes, flat-worms and round-worms).

(v) Fungi

The fungi are microscopic members of the vegetable kingdom. Some of them cause disease, ringworm being an important example of such a fungus.

Non-infectious and Non-contagious Conditions

Non-infectious diseases (caused by factors other than living organisms) include those resulting from: a low level of nutrition (especially from a lack of vitamins or minerals); mechanical injuries and lesions such as cuts, abscesses, ulcers and fractures; poisoning; hereditary conditions transmitted through the parents; excessive heat or cold; an insufficient or excessive production of hormones (see Section 10); tumours and certain disease conditions such as milk fever in dairy cattle.

Predisposing Causes

(Section 15)

These are causes of disease which open up or prepare the way for specific diseases. Such causes include: the age of the animals; climate and weather conditions, which may result in animals being exposed to heavy rain or severe cold, or tropical conditions of sun and heat and which may reduce the natural resistance of the animals to disease; pollution of water and air; poor feed such as mouldy hay and green crops causing "bloat"; excessive work; hereditary conditions handed down through parents and certain disease conditions.

Acute and Chronic Disease, Inflammation and Fever

(Section 16)

Acute and Chronic Disease

These terms are used to describe the course and duration of disease. Acute describes a disease which starts quickly and runs a short course. Chronic is used in the case of a disease which runs for a long or even indefinite period.

Inflammation (Acute)

This is the term used for the reaction of the body in overcoming injuries, irritants, fractures and disease. In the process of inflammation the tissues or parts pass through a number of stages (a) they become red as more blood with large numbers of white cells (see Section 7 - The Blood) comes into the area and (b) they become hot, swollen and painful and do not function properly. If the cause is removed, the part rested and heat or cold applied, recovery usually takes place.

Inflammation (chronic)

In chronic inflammation heat and redness are not so marked. Instead there is a slow swelling of the part as new hard tissue (composed mostly of white blood cells and fibrous tissue) is laid down by the body.

Fever

Fever is the term used to indicate a rise of body temperature usually accompanying an infection. The elevated temperature is usually accompanied by loss of appetite, increased respiratory and pulse rates, sweating and shivering.

Morbidity and Mortality
(Section 17)

These terms are frequently used in describing the results of disease in a herd or flock. Morbidity is the number of animals in a herd or flock which are affected by the disease but which do not die - if a large percentage of the animals become affected the morbidity is said to be high. Mortality is the number of animals dying from disease. Both mortality and morbidity are generally expressed as a percentage, e.g. 10 animals affected out of 100 would be 10 percent.

Epizootic, Enzootic and Sporadic Diseases
(Section 18)

Epizootic is the term used to denote a disease of animals (such as rinderpest) which spreads rapidly over a large area - it corresponds to the word epidemic which is used to describe a disease which rapidly spreads amongst human beings.

Enzootic is the term used to describe a disease which is continuously present in a population of animals but does not spread rapidly like an epizootic.

Sporadic is used to refer to a disease not normally present in an animal population but which appears suddenly from time to time and, equally suddenly, disappears.

Signs of Ill-health and Disease
(Section 19)

Before signs of disease appear there is a period after the disease organism has entered the animal's body when signs of ill-health or disease are not apparent. This is called the incubation period, its length depending on the disease concerned.

An experienced A.H.A. will at once recognize any abnormality in the appearance or behaviour of the livestock for which he is responsible when signs of the disease begin to appear. He will keep careful records of any such abnormalities so that he can give a detailed account of his findings to his Veterinarian.

The points of an animal in good health have been described (Section 12). An animal in ill-health will quickly show changes in many of these points. These changes are referred to as symptoms of the disease or condition.

Investigating and Reporting Disease
(Section 20)

In making an investigation of possible disease reported in a herd or flock the A.H.A. will need to obtain information on the following points:

(i) The name of the owner of the animals, the number he owns, their usual location and the grazing area they use.

(ii) The number of animals sick.

(iii) The number of animals that have died.

(iv) The period of time the dead animals have been sick.

(v) If any new animals have been added to the herd or flock during the previous month.

(vi) If in a dipping or spraying area, when were the cattle last dipped and at what dipping tank or spray race?

Having obtained this and any other relevant information, the A.H.A. will need to note the symptoms of the sick animals. His examination should be done systematically, the following points being covered, and recorded in writing.

(i) General appearance of animals when standing.

(ii) Body condition and condition of hide or skin of animals - do they have dull staring coats?

(iii) Is the appetite good? Or are they off their feed? Are the animals chewing the cud normally?

(v) Are the animals constipated or do they have diarrhoea? Is the urine normal?

(v) Do the animals cough? Are there any discharges from nose, mouth or other passages?

(vi) Are the eyes open and bright and the mucous membrane normal? Or are they pale or reddened?

(vii) Are any lymph nodes swollen?

(viii) What are the temperatures, respirations and pulse rates of a number of animals selected in the herd or flock?

(ix) Are many young animals affected?

In many cases the A.H.A. moving with or inspecting nomadic or transhumant herds or flocks (tribal people moving over large areas in search of grazing and water or the seasonal movement of livestock from one region to another e.g. valley to summer mountain grazing) will want to examine individual animals closely.

If possible, such examinations should be carried out at locations where handling or vaccination crushes are available but, if not, the owners of animals should be asked to bring out selected animals and have these thrown.

In countries where regular dipping or spraying is enforced at communal dipping tanks or sprays, facilities for inspection, handling and taking specimens are good.

A.H.A's in charge of dipping tank areas are in a good position to know from week to week the condition and general state of health of the animals in their areas, and should very quickly be aware of any unusual disease conditions arising in them.

Before reporting to his Veterinarian, an A.H.A. may need to take blood and lymph node smears and spleen and brain smears from dead animals. Specimens of blood, dung, skin scrapings, parts of organ, parasites if found and other material should be collected (see Sections 113-115 and Appendix 10.

Diagnosis
(Section 21)

Diagnosis of disease comes from observation of symptoms and changes in the tissues of the animals. Some symptoms are characteristic of specific diseases such as muscle spasms in tetanus and paralysis in milk fever, but more often a disease is identified only after a careful clinical examination of the animal or animals and after post-mortem and laboratory examination of smears and specimens have been made.

Even an experienced A.H.A. will be able to do little more than recognize various symptoms of diseases with which he may be familiar, collect specimens from live and dead animals for laboratory examination and report as fully and quickly as possible to his Veterinarian.

This is why the preparation of smears, collection of specimens, making post-mortems and handling carcases in the field are so important. The techniques and procedures involved in carrying out such duties will be found detailed in Sections 113-121 and Appendix 10.

CHAPTER 4

CONTROL, PREVENTION AND TREATMENT OF DISEASE

Immunity, Tolerance and Susceptibility

(Section 22)

(i) Immunity

When an infectious disease invades an animal's body the animal may develop the ability to resist it, in which case it is said to have an immunity to the disease.

The substances produced in the body which help the animal to resist disease are called antibodies.

Immunity of an animal to disease varies greatly from one disease to another. If the animal can resist the disease without having been vaccinated against it, the immunity is termed "natural immunity". If, however, the animal has been given vaccine against the disease its immunity is termed "artificial immunity".

"Premunity" describes a type of immunity to a disease in which the immunity of the animal is largely dependant upon the continued presence of the disease organism in the body.

Like other types of immunity, premunity can break down under the influence of adverse conditions or stress or on exposure to a high level of infection.

(ii) Tolerance

Tolerance is a form of resistance against disease acquired by animals of an animal population which have been in contact with a disease for many generations. The N'Dama cattle breed of West Africa is the prime example of this. The animals of this breed have a much higher degree of resistance to trypanosomiasis than breeds of cattle having had no contact with the disease.

(iii) Susceptibility

An animal is said to be susceptible to disease when it has no immunity, tolerance or resistance to the disease and goes down with the disease on exposure to it.

Prevention and Treatment of Disease
(Section 23)

Preventing Disease

As has been emphasized before, the most important form of treatment is preventive treatment and it is in this that the A.H.A. can play a vital part and it is this aspect of treatment which will be mainly dealt with in this Manual.

The prevention of most infectious diseases is centred on:

(i) The use of "biological agents" usually given by injection.

(ii) The use of chemicals which kill the intermediate host carrying the disease organisms, if such a host is involved in spreading the disease.

(iii) Isolation of affected animals and control of movement to prevent their infecting healthy ones.

Biological agents include vaccines which contain live organisms which have been modified so that they give only a mild attack of the disease and this makes the animal resistant or immune to the disease when the animal is subsequently exposed to it, and serums which are agents containing ready-made antibodies.

Biological agents, such as vaccines, must be very carefully looked after before being used and in this also the A.H.A. can be of great assistance (see Section 112 for Care of Vaccines).

Most of these products need to be kept cold (sometimes frozen) and protected from light. The syringes and instruments used to inject them into the animals must be clean and sterilized (see Section 111).

The chemicals used to kill insects and mites carrying disease organisms referred to above, are used mainly in dipping tanks and as sprays to kill ticks and keep their numbers down and to kill tsetse flies, the carriers of trypanosomes (see Section 14).

Treatment and Care of Animals

Treatment simply means dealing with the cause of the disease and helping nature and the animal's body to combat it.

The A.H.A. will rarely be able himself to treat sick animals although sometimes on the advice of his Veterinarian he may be able to give drugs or medicines to them. However, by reporting the sick animal quickly to the Veterinarian it may be possible to save the animal by appropriate drugs, medicines or surgery and, if the disease is an infectious or contagious disease, prevent its spread to other animals or protect them from the disease by vaccination.

An important aspect of treatment is the care (or nursing) of animals which are under treatment. This is dealt with in Section 130 in Chapter 15.

Animal Hygiene

(Section 24)

An important means of preventing and controlling disease is the maintenance of good animal hygiene.

If a herd or flock becomes infected with disease it is very important to remove the infected animals to a place where they are isolated from other stock. In some cases it may be better to isolate all the healthy animals.

Animals isolated in this way should be herded and looked after by herdsmen who have nothing to do with other stock or the herdsmen of other stock.

In outbreaks of disease the Veterinary Services of a country will often declare an area to be "in quarantine". This means that the movement of animals is restricted to a certain designated area laid down by the Veterinary authorities.

The A.H.A. can play an important part in this not only in supervising the animals and herdsmen involved but in convincing the local stock-owners of the necessity for such a measure.

Other measures which should be taken in preventing the spread of infection include the destruction of carcases by fire and their disposal by burial; the disinfection of buildings and pens where practical, and, where grazing-lands are heavily infested by parasites, the rotation and management of such grazing-lands as described in Section 13. These measures are generally best planned by the Veterinary Officer.

Control of Disease Under Government Legislation and Regulation

(Section 25)

Almost all countries have veterinary and animal health laws and regulations which are applied and must be observed by stock-owners when livestock are suspected of being diseased, when disease is present or even if animals are healthy. Under such laws and regulations quarantine and control of the movement of animals would be enforced.

They may provide for a "permit" system under which no animals are permitted to move from one place to another without a veterinary permit.

Under some permit systems no animals can be moved from one district or region to another, even if healthy, without a "no objection" permit having been granted by the Veterinarian or Senior A.H.A. of the district or region to which the animals are to be moved. For such a permit the number and kind of animals to be moved, the route by which they will travel, the place to which they are going and other such information has to be given.

When such a permit is granted movements have to take place within the time stated on the permit.

Under such Government laws and regulations animals suspected of disease may be ordered to be slaughtered (sometimes compensation in such cases is provided for).

Regulations may also be published governing movement of hides and skins, meat, dairy produce and hay.

Most countries have laws which specify those diseases which are "notifiable", i.e. if any of these diseases are suspected they must be notified at once to the local veterinary authority or police.

The A.H.A. would often be the representative of the Veterinary Service first to be notified and would immediately undertake an investigation in order to inform his Veterinarian.

The diseases to be notified under such laws vary from country to country but the diseases almost always included in such a list are: rinderpest, foot and mouth disease, contagious bovine pleuropneumonia, anthrax, rabies, sheep pox, sheep scab, swine fever and swine erysipelas.

Arrangement of Sections Dealing with the Animal Diseases

(Section 26)

In a Manual such as this it is not possible to describe in detail every disease of all the animals dealt with (cattle, buffaloes, sheep, goats, pigs and camels), and to which they are susceptible.

Many diseases in different animal species are caused by the same, or closely related organisms. Some diseases only occur in certain species, while other diseases, which affect many species, have a much greater degree of virulence for certain species than for others.

It must also be appreciated that some diseases are present in certain countries or certain areas and not in others and these will, of course, be known to the A.H.A.

The method adopted in this Manual to avoid repetition and to keep the Manual as small and handy as possible is therefore as follows:

First, in Part 3 which follows, the main diseases affecting cattle and buffaloes are described in separate chapters according to whether they are bacterial, viral, protozoal and rickettsial, parasitic or non-infectious. While the diseases of buffaloes are similar to those of cattle, there are certain differences in prevalence, symptoms, pathogenicity and in the control measures which need to be exercised. These differences are indicated in the text.

Some diseases only affect cattle and buffaloes (e.g. East Coast fever, haemorrhagic septicaemia, sweating sickness), while others such as tuberculosis, rabies, anthrax, foot-and-mouth disease) can also affect sheep, goats, camels and pigs to varying degrees. Part 4 deals with the diseases of these other animal species; first the diseases which are specific to each animal and then in a list, those diseases which occur in cattle and buffaloes and which were described in previous sections of the Manual.

PART 3

DISEASES OF CATTLE AND BUFFALOES

Fig 17 - POINTS OF THE WATER BUFFALO COW. (See sections 27 - 80)

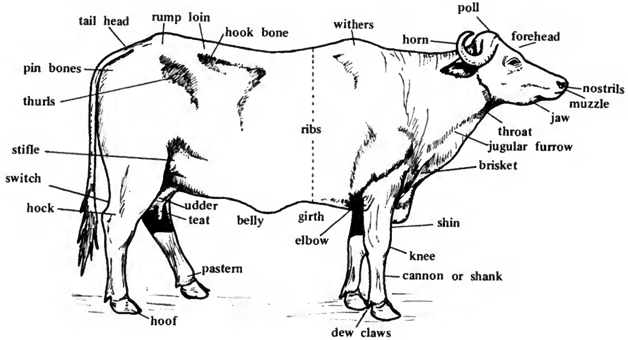
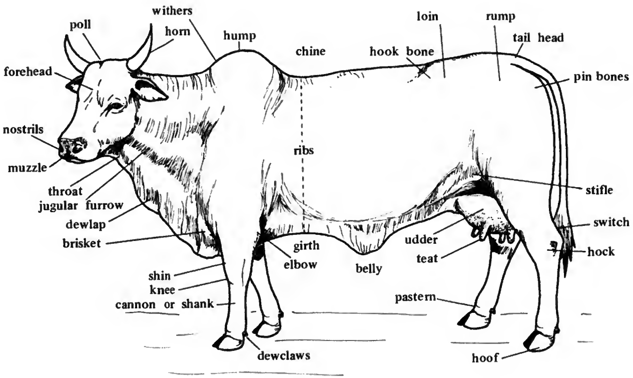


Fig 18 - POINTS OF THE COW. (See sections 27 - 80)



CHAPTER 5

DISEASES OF CATTLE AND BUFFALOES CAUSED BY BACTERIA

Anthrax

(Section 27)

Nature and Occurrence

An acute infectious disease of all warm blooded animals and man caused by a large bacillus (Fig.19) capable of forming spores on exposure to air and able to survive for many years in the soil. The disease is found world-wide but is more common in tropical countries.

The organism enters the body through a wound or is inhaled or ingested. The incubation period is from 1-5 days.

Symptoms

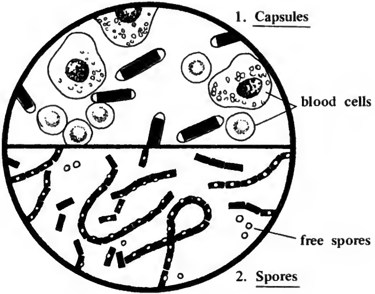
In many cases, the disease takes a very acute form, the animal being found dead with no previous illness having been observed and with bloody discharges from nose and anus.

The most characteristic features of the disease are: the sudden onset, high fever; difficult breathing; staggery gait; extreme weakness and rapid death.

In pigs and horses symptoms are sometimes less acute and swellings of the throat develop.

If an animal dies suddenly without previous signs of disease, anthrax should be suspected.

Fig 19 - Bacillus anthracis SHOWING CAPSULES AND SPORES UNDER A MICROSCOPE.



(See section 27)

In this case no post-mortem should be attempted. A blood smear should be taken as soon after death as possible from the ear or tail to avoid blood contaminating the surroundings. The smear should be sent for immediate examination. If the carcase is opened in error, blood will be dark, unclotted and look like tar; the spleen will be very much enlarged, its substance dark, soft and like tar. The A.H.A. must be very careful to wash himself thoroughly and boil his clothing for 20 minutes before its re-use since the disease readily infects man.

Control and Prevention

Carcases of animals having died of anthrax or even suspected of having died of the disease should be buried 1.8 m deep, covered with quick lime (if available), and the area fenced off.

All infected material, soil and bedding etc. should be burnt.

All susceptible animals should be kept away from infected areas and vaccinated (with a single dose of vaccine); thereafter animals should be vaccinated annually for at least three years after the last case.

The Veterinarian should always be informed of suspected anthrax cases, and blood smears sent to him. In some cases he may decide to treat in-contact animals with penicillin.

Blackquarter - (Quarter-evil, Blackleg)
(Section 28-1)

Nature and Occurrence

An acute infectious disease of cattle, sheep and pigs (see also malignant oedema (Section 28-2), caused by a bacillus of the genus Clostridium (Cl. chauvoei) which occurs in soil and in the gut of normal animals and which may invade the body through a break in their skin or mucous membrane. The organism produces spores which are very resistant to heat and survive a long time in soil. They develop only in absence of oxygen.

In cattle, young adults 8 - 18 months old, are most often affected and sheep after shearing. The disease is widespread in tropical countries. Pigs are less susceptible.

Symptoms

The animal is first noticed to be lame, then develops a swelling over upper part of leg, which rapidly spreads and crackles on touch, due to gas under the skin; movements are painful; there is loss of appetite and cessation of rumination; very high temperature and accelerated respirations.

The disease progresses rapidly with grunting and grinding of teeth, death occurring suddenly within 12-48 hours of onset, often being preceded by bloody discharges from nose and anus.

Diagnosis

If blackquarter is suspected, a blood smear from the muscle swelling should be made and sent immediately for examination. The blood smear will quickly differentiate this disease from anthrax.

No post-mortem should be attempted, but if a cut is made into a muscle swelling it will appear black, dryish and having the smell of rancid butter.

Control and Prevention

Carcases should be dealt with as in anthrax. In infected districts all cattle, from six months to 3 years of age, should be annually vaccinated. Sheep should be vaccinated before shearing.

Malignant Oedema

(Section 28-2)

Nature and Occurrence

A disease closely related to blackleg affecting sheep, cattle and other animals and caused by a similar organism Clostridium septicum. The disease occurs world-wide but in certain areas of a country where the soil conditions favour survival of the organism, the disease may occur in endemic or even epidemic form (Braxy) although it most often occurs sporadically.

Symptoms

Swellings develop in the musculature consisting of jelly-like haemorrhagic fluid. There is less gas present than in blackleg lesions. The swellings cause reluctance to move, pain and the other symptoms of blackleg.

Diagnosis

As for blackleg.

Control and Prevention

Animals, especially sheep, in endemic areas should be vaccinated annually with a vaccine against Cl. septicum.

Good hygiene especially during operations such as castration, shearing and parturition and proper treatment of wounds will reduce the incidence of the disease.

Botulism (Lamziekte Disease)

(Section 29)

A world-wide disease of all livestock, caused by a toxin produced by one of the Clostridium micro-organisms (Cl. botulinum) which grow in the soil under oxygen-free conditions and produce the toxin. The organism is spore forming and in this stage persists for years in soil, etc.

Animals may take up the toxin with contaminated fodder or feed or in water contaminated by a carcase in which the spores have multiplied.

In southern Africa, and other countries where animals are apt to chew bones because of a deficiency of minerals in the soil, the disease is common, the toxin being generated within the bone marrow and adherent flesh.

Symptoms

The toxin affects the nervous system of the animal resulting in staggery gait, difficult swallowing, drooling at mouth, stary eyes, paralysis of tongue, lips, throat and legs and general weakness. Animal goes down, breathing is affected and the animal dies within 1 - 4 days.

The disease may sometimes occur in a chronic form, the symptoms lasting for several weeks.

In sheep the affected animal may walk in circles with its head on one side. These symptoms can be confused with rabies.

Treatment, Control and Prevention

Treatment is not effective. Control and prevention consists of the proper disposal of all carcases, the provision of fresh water supplies, remedying any mineral deficiency present and by vaccination.

Calf Diseases

(Section 30)

General

High mortality in calves is widespread and represents a great waste of animal resources.

Most problems in calves are caused by faulty nutrition, either inadequate colostrum, insufficient milk (very common if stock-owners are anxious to sell the milk); failure to control worm infestation; lack of vitamin A, or sometimes as a result of feeding too much or too rapidly.

Feeding on the cow is the best procedure since calves in their early days feed little and often.

Artificially fed calves should be fed the correct amount at each feed for their age and be given the correct number of feeds per day for that age.

In any case it is vitally important that the calf, during its first 4 days, should receive the colostral milk of its dam and the antibodies which are in it. This will ensure the calf having a high degree of resistance against disease.

It is also good practice to dip the calf's navel (umbilical cord) in tincture of iodine immediately after birth. This is especially important if the cow has had to be assisted in the delivery of the calf.

Calves should always be kept under hygienic conditions in clean uncrowded pens with plenty of bedding material and kept away from contamination by older animals.

Utensils used for hand feeding should always be kept scrupulously clean and the calves should always be given high quality feed and be kept free of ticks, other external parasites and internal parasites.

The damage caused to the calf's digestive system by incorrect feeding may open the way to

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infection with specific micro-organisms such as E.coli, salmonella or various viruses. The resultant infections may be spread within the herd to previously healthy calves.

Calf Diphtheria
(Section 30-1)

Nature and Occurrence

An acute infectious disease of young calves but young lambs and piglets may also become infected with a similar disease. The disease spreads rapidly especially in housed animals.

The cause is a bacillus (Fusiformis necrophorus) which appears to be closely involved in foot rot disease (Section 33). Bad feeding (including use of coarse feeds) and unhygienic conditions predispose to calf diphtheria.

Symptoms

The calf refuses food and there is coughing, salivation, high temperature, development of rough, greyish-yellow deposits on the mucous membranes of gums, cheeks, palate and tongue resulting in an unpleasant smell and swelling of the face.

Breathing and swallowing become difficult; pneumonia may develop, animal becomes weaker and eventually dies.

Diagnosis

This is based on symptoms but the head of a dead calf can be sent to the laboratory for confirmation.

Treatment, Control and Prevention

Sulphonamides and antibiotics are effective treatments in the early stages. To prevent spread of disease, coarse feed or feed with thorns in it should be avoided.

White Scours of Calves (Colibacillosis)
(Section 30-2)

Nature and Occurrence

Primarily a disease of calves predisposed by bad artificial feeding and management. Lack of colostrum; feeding milk in excessive amounts, at one time or at irregular intervals, or milk which is too cold and lack of green feed in the dams diet may all result in this condition.

Scours are generally caused by a micro-organism (Escherichia coli) normally present in the intestines of cattle and man.

Symptoms

Mainly a disease of young calves under 2 weeks of age.

The faeces are white or yellowish with a characteristic smell. Death may occur within a week and calves recovering may remain unthrifty and may develop a chronic cough.

Treatment, Control and Prevention

Treatment should be attempted, although this may often be unsuccessful.

Milk should be withheld completely for 24 hours after onset of symptoms after which a wheat or maize meal gruel or warm water can be given to which increasing amounts of milk are added daily until two-thirds of the total feed is milk.

Colostrum from a newly calved cow in the same herd may be of considerable value. Up to half a litre daily by mouth should be given.

Individual calves can be treated with intravenous or subcutaneous injections of sterile saline solution to counteract the loss of body fluids, but this can usually only be done under the supervision of a Veterinarian.

Sick calves should always be fed from their own buckets or all buckets should be sterilized before being used.

Calf Paratyphoid

(Section 30-3)

Nature and Occurrence

Caused by a specific bacterium of the genus Salmonella. The disease is similar to calf scours but occurs in older calves between 6-12 weeks of age. Lambs are also affected. The disease, which occurs world-wide, spreads rapidly once introduced to a group of calves.

Symptoms

Affected calves become dull, go off feed and have a high temperature. At first they are constipated but this later turns into a yellow, stinking diarrhoea, sometimes darkened with blood.

Mortality may be high, especially if a large number of calves become infected.

On post-mortem, liver will be found swollen and both it, and the kidneys will have a mottled appearance. The rumen and the intestines will be inflamed.

Diagnosis

A specimen of the liver and/or mesenteric lymph nodes in 50% glycerine saline or on ice should be sent to the laboratory.

Treatment, Control and Prevention

Drugs such as nitrofurazones and antibiotics are available for treating the disease. The Veterinarian will decide which should be used. Supportive treatment with glucose saline injections often helps in individual cases.

Vaccination is not wholly effective but whenever possible, calves should be vaccinated against the disease during the first 14 days after birth.

Brucellosis
(Contagious Abortion - Bang's Disease)
Section 31)

Nature and Occurrence

A chronic infection of cattle and buffaloes affecting the reproductive organs and causing abortion in cows usually at around 7 months. The disease occurs world-wide and is caused by a bacterium, Brucella abortus, which infects the animal as a result of ingestion of contaminated feed or herbage. In pregnant animals the organism enters the uterus and infects the foetal membranes and causes abortion of the foetus.

Two other closely-related organisms, Brucella melitensis and B.suis cause brucellosis in sheep, goats, and pigs and all three species can infect man. The disease caused by B.abortus in man is called "undulant fever" while B.melitensis causes "Malta fever". Man is usually infected by drinking milk from affected animals or by handling infected after-births or discharges at abortion. (See also Section 83.)

Symptoms

Abortion of foetus between the 5-8th months. As a result, the foetal membranes (after-birth) may be retained for a long period and cause sterility in the cow.

Diagnosis

If a cow aborts, a blood sample should be taken at once and a second sample 30 days after the abortion. This is the best way to confirm a diagnosis. It involves taking 5-10 cc of blood from the jugular vein into a dry tube or bottle. If it takes a long time to reach the laboratory, one part of a 10 percent solution of boric acid is added to 10 parts of blood.

Smears can also be made from aborted calf's stomach. (See Section 113 .)

A mixture of milk from all the cows in a herd (up to 40) can be put into a bottle and sent to the laboratory (adding 5% formalin if the milk will take more than 24 hours to reach the laboratory) for what is known as the "Ring Test". This will show whether infection is present in any of the cows.

Control and Prevention

In a few countries, animals in an infected herd are tested and the reactors slaughtered but this is rarely practical. In most countries all heifer calves 3-9 months of age (according to the type of vaccine used) are vaccinated, which gives them an immunity against the disease for life. Great care has to be taken in the handling of the vaccine before and during vaccination. (Vaccine can cause infections in man.)

Vaccination interferes with subsequent blood tests so that both methods cannot be used in the same herd. All vaccinated animals should be ear-tagged or the ear notched.

The Veterinarian will decide on the procedure to follow and may recommend that all the cows in the herd should be vaccinated as well as the heifer calves.

Since the disease is spread from herd to herd by an infected animal being moved into a non-infected herd, it is very important that all animals being brought into a clean herd should first be tested. In any case, heifers or cows brought in should be kept in isolation and segregated from the clean herd until they have calved and have been tested 30 days after, as described above.

When cows abort, all infected material (the aborted calf and the foetal membranes, etc.) should be burnt and the areas where the abortion occurred disinfected. Milk from females which have aborted should also not be used unless it is first boiled.

The policy for combatting brucellosis is determined nationally by the government veterinary directorate concerned. The methods of control used by the Veterinarian and the A.H.A. in individual herds in a particular country will always be in accordance with that policy.

Contagious Bovine Pleuro-pneumonia (CBPP)
(Section 32)

Nature and Occurrence

An infectious disease of cattle, and possibly buffaloes, widespread in many tropical countries causing heavy losses. It is caused by a very small bacterium Mycoplasma mycoides and is spread by material coughed up by an infected animal. The disease spreads slowly and rarely appears as an epizootic.

Symptoms

Temperature rises; animals are dull and off their feed; breathing becomes laboured and painful; a persistent cough develops; animals stand with elbows out, head facing the wind and nostrils distended.

Many animals recover without showing obvious symptoms but these may then remain carriers of the disease and infect others.

At post-mortem examination the lungs will be found affected. Pneumonia is often on one side only or in small or large areas of one of the lungs. Areas of dead tissue may be found separating healthy areas. Pleurisy (inflammations of the pleura - the serous membrane covering the lungs, which also lines the thoracic cavity), may also be present. The chest cavity may contain a yellow coloured fluid.

Diagnosis

This is often difficult. It is best done from the post-mortem examination of a dead animal or one slaughtered for the purpose. The typical "marbled" appearance of the lungs is diagnostic.

Pieces of lung in glycerine, together with fluid from the chest cavity should be sent to the laboratory where the causal organism can be identified.

Control and Prevention

Control may be by testing (for which blood samples are required), slaughter, quarantine and/or by vaccination, the methods depending on local circumstances. Although the disease can be treated successfully with tylosin, (an antibiotic), this is not widely used. Vaccination is effective but may cause a severe local reaction.

The Veterinarian should be informed at once if CBPP is suspected.

Foot Rot (Foul-in-Foot)
(Section 33)

Nature and Occurrence

An acute infection of the feet in cattle caused by various bacterial micro-organisms, the principle one being Fusiformis necrophorus, a bacillus. The organisms live in the soil and if the feet of cattle have been subjected to wet conditions for long periods and then are injured (e.g. by a sharp stone) the organisms enter the foot.

Symptoms

Animals go lame, the area around the top of the foot becomes inflamed, swells, eventually breaking out in small abscesses. Cracks appear in the skin between and around the hooves, smelling badly.

The animal goes off feed, loses condition, develops diarrhoea, high temperature and may be unable to stand.

Diagnosis

The A.H.A., in examining a number of animals which are lame should be sure the disease is not foot and mouth disease. In foot rot, there will be no ulcers or lesions in the mouth.

Treatment, Control and Prevention

Treatment of a few infected animals consists of cutting away diseased tissue and dressing the affected foot with tincture of chloramphenicol (often available as an aerosol), or 10% copper sulphate solution. Intravenous injections of sulphadimidine are also effective.

Infected animals should be segregated for treatment. Uninfected animals should be placed on dry ground and walked through a foot bath (such as in a dipping tank) containing 5% copper sulphate solution daily for a week and then weekly thereafter.

Haemorrhagic Septicaemia
(Pasteurellosis - Shipping Fever)
(Section 34)

Nature and Occurrence

An acute infectious disease of cattle and buffaloes caused by a small, non-spore forming bacillus (Pasteurella multocida) present in the naso-pharynx of healthy animals which act as carriers from where it spreads by inhalation or ingestion to susceptible animals. A similar organism causes pasteurellosis in many other species of animals. It is world-wide but especially in India, South East Asia, Africa, Central America and Latin America.

Overwork; low levels of feeding; overcrowding and hard conditions of transport to market (hence 'shipping fever') and other such stress conditions, pre-dispose to the disease. Buffaloes appear highly susceptible to the disease.

Symptoms

In many cases no symptoms are apparent but the animal dies suddenly.

In other cases symptoms include one or more of the following: high temperature; off feed; diarrhoea; bloody faeces; internal pain; swellings of the throat, head, brisket, legs or root of tail. Throat lesions lead to distressed breathing and difficulty in swallowing. In calves the whole head may swell and the condition may be mistaken for snake bite.

The animal becomes very depressed. Death may occur suddenly 1-2 days after the onset of symptoms, but in some cases the disease may become chronic, such animals being carriers of the disease. Such carriers should be destroyed. Mortality is higher in young animals.

Diagnosis

At post-mortem, the following lesions may be found: swollen lymph nodes; haemorrhages under the skin, on the intestines and in the heart, and a sticky yellow fluid in the body cavities and the swollen tissues.

The bacterium is seen in smears taken from lesions or blood.

Haemorrhagic septicaemia may be confused with contagious bovine pleuro-pneumonia or bovine malignant catarrh (see Sections 32 and 46), especially if it is in the chest form. The spleen is usually of normal size, distinguishing it from anthrax.

Treatment, Control and Prevention

Treatment, using sulphonamides or tetracyclines, is effective if started early enough. It is often worth while to take the temperature of all apparently healthy, in contact animals and to treat any with raised temperatures.

Once diagnosis of the disease has been made in a herd, in contact animals should all be vaccinated with the vaccine decided upon by the Veterinarian.

In some areas where, for example, the disease occurs seasonally with the onset of the rainy season, vaccination should be carried out 1-2 months before the season is due to start.

Because excessive work, over-crowding, poor environmental and feeding conditions and transporting animals to market may predispose to the disease, good management and hygiene should be insisted on at all times.

Infectious Kerato-conjunctivitis
(Infectious Ophthalmia - Pink eye)
(Section 35)

Nature and Occurrence

A disease spread by insects affecting the eyes of cattle, sheep and goats in most tropical regions of the world, particularly in Africa, Far East and Latin America. Caused by a rickettsial organism, but conveniently dealt with here.

Symptoms

Disease starts with a profuse flow of tears, at first from one eye and later from both. Conjunctiva and eye-lids become swollen. An opacity may appear over eye and discharge may become muco-purulent.

In due course animals usually recover, but a proportion may be left blind.

Treatment, Control and Prevention

Treatment should start early with antibiotic eye ointments - animals being kept in dark surroundings.

The herd should be kept as free from flies as possible.

Johnes Disease (Paratuberculosis)
(Section 36)

Nature and Occurrence

A chronic, incurable, infectious disease of cattle and other ruminants world-wide, caused by a bacillus Mycobacterium johnei. It may first be detected in exotic animals introduced into a region for grading-up the local stock.

Cattle, sheep and goats are most commonly affected, but the disease has been reported in buffaloes, camels and yaks. It is spread by direct and indirect contact through feed and water, contaminated with faeces.

Symptoms

Infected animals lose condition and show reduced milk yields.

A bubbly diarrhoea with a characteristic smell sets in, intermittent at first, then becoming continuous. Affected animals become severely emaciated and die.

In sheep, diarrhoea may not be present but infected animals suffer from chronic wasting.

On post-mortem, parts of the walls of the small intestines will be thick and mucous membranes corrugated and reddened.

Diagnosis

Diagnosis is difficult but the disease may be confirmed in the laboratory from faecal specimens, or from pieces of affected gut wall preserved in 10% formalin.

Control and Prevention

No treatment is known. Infected animals and their calves are best slaughtered since they can spread the disease.

Strict maintenance of hygiene and proper disposal of infected faeces and bedding are essential.

Calves in an infected herd should be kept quite separate from adults.

Infected pastures should be kept free from all ruminants for at least one year, and if possible ploughed and planted to crops.

Leptospirosis
(Section 37)

Nature and Occurrence

A contagious disease of animals (including wild life) and man, occurring world-wide, and caused by a bacteria with the form of a spiral called Leptospira.

There are numerous Leptospira species and some of these cause disease in man, cattle, pigs, sheep and goats and other animals. The disease is less important in sheep and goats.

The disease is spread through direct contact with urine or even from water or feed contaminated by urine. Rats are particularly important carriers.

Symptoms

Symptoms which may be absent in adult cattle even though disease is present include high temperature; abortions; reduced milk production, blood and clots in the milk; jaundice, and blood in the urine.

On post-mortem the principal lesions may include an enlarged yellowish liver and swollen kidneys with haemorrhages.

Diagnosis

Diagnosis of the disease can only be done in the laboratory. It requires samples of blood and serum or freshly collected urine and specimens of kidney or liver tissues in 10% formalin.

Treatment, Control and Prevention

Treatment is possible with antibiotics, but is costly, and the Veterinarian will advise on whether this should be attempted. The Veterinarian will also advise on the practicability of vaccination.

Because of the danger to man, rats and other rodents around buildings should always be eliminated.

Metritis

(Section 38)

Nature and Occurrence

A non-infectious inflammation of the uterus of any species of animal often resulting from the retention of the after-birth (placenta) which becomes putrid. Usually infection is caused by a mixture of common pus-producing bacteria.

A specific form of (contagious equine metritis (CEM)) exists in horses which is spread at mating and is highly contagious.

Symptoms

Parts of the after-birth may be seen hanging from the vulva. The cow becomes dull, goes off its feed, develops a temperature, has a discharge with pus from the vulva and its milk production is reduced.

If the damage to the lining of the uterus or the fallopian tubes is severe, sterility will result

Treatment, Control and Prevention

Treatment will be carried out by the Veterinarian, but gentle removal of the after-birth left hanging from the vulva will help prevent the infection.

Dermatophilosis
Cutaneous Streptothricosis - Senkobo Disease
Section 39-1)

Nature and Occurrence

A dermatitis mainly of cattle found in many countries particularly in those of tropical West Africa. It is also found in the Far East and Latin America. Goats, horses and wild animals can also become infected but some cattle breeds, notably the N'dama and Muturu are resistant. It is caused by a bacterium, Dermatophilus congolensis, which is also the cause of Lumpy Wool in Sheep (See Section 39-2).

The disease spreads from one animal to another, usually in the rainy season, through injuries to the skin such as cuts, wounds and the bites of ticks and flies. It may disappear in the dry season.

Symptoms

All parts of the body can be affected but particularly the back, sides and belly, inside the legs, the face and the ears.

Pimples first form from which serum is exudated which forms scabs. The hair becomes wet and matted, forming lesions resembling a paint brush. The scabs may extend over the body in large patches.

The animal becomes weak, loses condition and may be unable to graze and thus starves to death.

Diagnosis

The seasonal incidence of the disease and the characteristic appearance of the affected parts, together with the laboratory examination of pieces of affected skin and scabs, in which will be found the causative organism, confirms the disease.

Treatment, Control and Prevention

The injection of antibiotics, the removal of scabs and the use of bactericidal washes may cure the condition in some cases.

Regular and frequent dipping to protect animals from ticks and flies, removal of thorn bushes from grazing areas, and, if cattle are valuable, keeping them under a roof in the wet seasons. may all help to control the disease.

Badly affected animals should be slaughtered to prevent them spreading the infection.

Lumpy Wool in Sheep
(Section 39-2)

In sheep the same organism causes a condition known as "lumpy wool". This condition is widespread where wool sheep are kept.

Crusts and scabs form on skin areas, the wool matting and forming hard tufts. Young lambs may die of the disease. Treatment consists of shearing sheep and treating areas with a half percent of copper sulphate solution.

Tetanus (Lockjaw)
(Section 40)

Nature and Occurrence

A world-wide, acute, infectious disease resulting in stiffening and spasms of body muscles. Symptoms are caused by a toxin or poison produced by the tetanus bacillus, Clostridium tetani acting on the nervous system. The organism can live for long periods in soil or manure and the disease generally results from the organism growing in a deep wound, (accidental or man-made) into which it has been introduced.

In some countries any animals or man receiving a cut or wound must have an anti-tetanus injection.

Symptoms

The incubation period may be from 4-14 days. The first symptoms appearing are muscular stiffness and spasms of muscles. The muscles, initially those of the tail and ears, become hard and rigid and later, when the muscles of the jaw become affected, these are held tightly closed (lockjaw) and the animal cannot eat. If the animal is not treated it will die of thirst and starvation or asphyxia resulting from spasm of the muscles used for breathing.

In the horse a prominent symptom is the protrusion of the third eyelid (nictitating membrane) over the eyeball.

Mortality varies but mild cases may recover sometimes after weeks or months.

Diagnosis

Diagnosis is based on symptoms. Post-mortem lesions are non-specific and are of no value in diagnosis.

Treatment, Control and Prevention

Cattle are easier to treat than other animals but treatment is usually unrewarding and uneconomic. It consists of the immediate injection of antitoxin (if available) followed by thorough cleaning and disinfection of the wound. Antibiotics at full dosage will destroy the organisms producing the toxin, provided the wound has been cleaned of pus, but they will not destroy the toxin already formed and attached to the nervous system.

Great care must be taken when even simple operations such as castrations are undertaken. Wounds must be kept clean and disinfected. In endemic areas any animal (but especially horses), if wounded or cut, should receive an anti-tetanus injection.

In areas where the disease is enzootic, the disease can be prevented by the use of a vaccine (toxoid) 2 or 3 injections being given over some 8 months and thereafter annually. The Veterinarian will give instructions on this.

If the A.H.A. is working in an area where tetanus is common, he should be protected against the disease by a course of injections.

Tuberculosis
(Section 41)

Nature and Occurrence

A chronic, infectious disease affecting all species of animals and man. It is present in most countries of the world and caused by certain hathogenic mycobacteria.

The disease in all species is known as tuberculosis and three main types of the tubercle bacilli are recognized, the human, the bovine and the avian. Infection takes place either by inhalation of infected droplets resulting from the coughing of an infected animal, or by ingestion of feed contaminated by discharges from infected animals, e.g. calves and pigs drinking milk from infected cows.

It has a long incubation period.

Tuberculosis is economically of greatest importance in cattle, buffaloes, pigs and camels. The East African zebu appears to be more resistant to tuberculosis than European breeds or the long-horned Nilotic breeds.

Symptoms

Symptoms vary according to where the tuberculosis organism is located in the animal. In housed animals infected by inhalation, the disease is most common in the lungs, the animal developing a cough, gradually becomes thinner and eventually dies.

If the animal is infected via the mouth, the main lesions may be in the throat, udder or intestines. In the latter case, it may be accompanied by diarrhoea.

Whatever its location the lesion is characterized by a 'tubercle' consisting of a yellowish-white area formed by the organisms and the cells of the host's blood fighting the infection. Tubercles vary in size from pin-head to a large egg and may be hard and waxy or contain liquid pus, or, in long-standing cases, calcified deposits. They may be very extensive, even in animals showing few clinical signs. The nearby lymph nodes are also involved.

Animals die when the tubercles are so numerous or large that the organs in which they may be located cannot function.

The disease is often found only at meat inspection after slaughter. This is one reason why meat inspection is so important, since it prevents not only infection in man from the eating of infected meat, but indicates the existence of the disease in the herd from which the animal was derived.

Diagnosis

The disease may be confused with diseases such as contagious bovine pleuro-pneumonia, but can be distinguished at post-mortem and confirmed by sending an infected piece of tissue, e.g. a lymph node preserved in 50% glycerine or 10% formalin to the laboratory for confirmation.

In the live animal, the tuberculin test is used for diagnosis. This test consists of the intradermal injection of tuberculin (a fluid made from the organism) into the skin of the animal suspected of the disease. In an infected animal, a swelling forms which occurs at the site of the injection and which can be measured by the use of calipers. The test can be made on the side of the neck or under the tail.

The A.H.A. may have to carry out this test but if he does, he will be carefully trained by the Veterinarian to do it..

Control and Prevention

Treatment should not be attempted. The only effective means of control is the periodic testing of herds every 6-12 months and the immediate removal of any "reactors" for slaughter, until the herd is free from disease.

A healthy herd can gradually be built up from an infected herd in this way. Many countries have eliminated the disease by this method, which involves the compulsory testing and disposal of reactors (often with payment of compensation) under the law.

There is no effective vaccine against tuberculosis.

Prevention of the disease can only be ensured by eliminating "reactors" and so preventing infection of healthy animals within the herd and by the quarantine and testing of all animals before they are allowed to join the herd.

It must be remembered that when tuberculin testing is undertaken, all reactors must immediately be taken out of the herd and either isolated or eliminated. Strict hygiene must then be practised to prevent infection of the healthy animals.

Vibriosis - Bovine Genital Campylobacteriosis
(Section 42)

Nature and Occurrence

A genital disease of cattle (bulls and cows) caused by a bacterium and transmitted at mating or by artificial insemination with contaminated semen. The disease is world-wide but is not considered to be present in indigenous cattle of the tropics that have had no contact with imported exotic cattle. However, because developing countries are now importing large numbers of exotic, high-yielding animals, it is important that the existence of this disease should be known as it may be imported with such cattle.

Symptoms

Susceptible cows may abort when they first contract the disease but once the disease is established in a herd the symptoms are reduced fertility and low calving rates with many cows returning to service 6-12 weeks after mating. This is due to the early death of the foetus, the cow returning to service after the foetus is aborted (unnoticed) or reabsorbed. Most abortions in cattle occur about the fifth or sixth month of pregnancy. Sometimes the disease may clear up in the female of its own accord.

Although an infected bull spreads the disease, he shows no symptoms of the disease.

Diagnosis

Low fertility with abortions or long intervals between services may lead to suspicion of the disease, but these may be the result of other infections or diseases.

Confirmed diagnosis can only be obtained from laboratory tests. The laboratory will require mucus on swabs from the vagina of cows or from the prepuce of the bull, or blood samples, but these must be sent on ice and must reach the laboratory within a few hours. Smears from the stomach of an infected foetus can also be sent.

Treatment, Control and Prevention

It is not practicable to treat cows, but antibiotics can be used in washing out the sheaths of bulls.

Vaccines are available, but are not widely used.

To control and prevent the disease, A.I. using semen from tested bulls is used. If this is done in herds where infection is established, 99% of the cows will throw off the infection within 12 months.

Control of the disease will need to be planned by the Veterinarian.

Wooden Tongue and Lumpy Jaw
(Section 43)

Nature and Occurrence

Two distinct, chronic diseases of cattle, affecting the mouth and related structures.

Wooden tongue (acinobacillosis) is caused by Actinomyces lignieresi organisms which enter a small wound in that organ.

Lumpy jaw (actinomycosis) results from infection by Actinomyces bovis of the bony tissues of the head, usually through abrasions of the gums. The diseases, although caused by different bacteria, are conveniently considered together here.

Symptoms

The animal slowly experiences increasing difficulty in eating and chewing and, as a consequence, loses condition. In wooden tongue, the organ becomes swollen and hard and may develop ulcers on the surface.

In the case of lumpy jaw, hard swellings appear either in the upper or lower jaw. These later soften and from them, through small openings, pus may be discharged.

Diagnosis

Diagnosis is confirmed by the examination of pus smears in the laboratory or from postmortem when diagnosis can be made from the lesions.

Treatment, Control and Prevention

Wooden tongue can be treated, under the supervision of the Veterinarian, using iodine solutions or with antibiotics. Lumpy jaw seldom responds to treatment and this is rarely justified except in the case of valuable breeding animals.

CHAPTER 6

DISEASES OF CATTLE AND BUFFALOES CAUSED BY VIRUSES

Foot-and-Mouth Disease

(Section 44)

Nature and Occurrence

A highly infectious disease of cloven footed animals caused by a virus. It is widespread in many tropical countries and affects cattle, buffaloes, pigs, sheep and goats and many wild species.

There are several different types and subtypes of the virus. Although not causing heavy mortality, especially in the case of *Bos indicus*, the reduced production resulting from infection and the need to restrict movement of animals to prevent its spread makes it one of the most serious diseases in the world.

Symptoms

Symptoms are often of short duration; mild in mature African cattle, more severe and prolonged in temperate zone breeds. In African or Creole cattle, the only marked symptom may be lameness in a number of the herd.

Symptoms include: high temperature; loss of appetite; staring coat; inside of mouth inflamed; formation of vesicles (small blister-like prominences) on the tongue and dental pads. These vesicles soon rupture, resulting in ulcers, with resultant difficulty in chewing, and drooling of saliva. Vesicles may also occur between claws and around the hooves with consequent lameness. Hooves may become detached. Vesicles and ulcers sometimes form on the udder and teats and animals quickly lose condition. Milk production is greatly reduced.

Diagnosis

At post-mortem, vesicles or ulcers may be found in the mouth, pharynx, oesophagus, trachea and bronchi. Sometimes yellow striping of heart, particularly in calves.

Owing to the urgent need to take control measures, diagnosis must be made as quickly as possible. Specimens of vesicles from the foot or mouth lesions should be taken, the "skin" from an unruptured vesicle being the best specimen. They are sent to the laboratory in 50% buffered glycerine saline for typing. Blood serum specimens should also be sent. Accurate diagnosis and typing is most important for foot and mouth disease control as the choice of vaccine depends upon the type and sub-type of virus causing the outbreak against which the vaccine will be used.

Control and Prevention

In some countries, which have high producing, exotic cattle, control may be by slaughter (with compensation) and/or mass vaccination using vaccines prepared from the same sub-type of virus as that causing the outbreak.

The Veterinarian will decide which policy should be applied in the particular country concerned.

In some parts of Africa, where the disease is enzootic, a slaughter policy may be too expensive, and even vaccinations may not be applied. The strict quarantining of the infected area, together with a programme of artificial spread of the disease is still used to restrict the spread of the disease in such areas.

In this case, vesicular material is taken from infected animals and injected, or rubbed into the mouth of non-infected, susceptible animals which are then kept under strict quarantine until all have recovered from the infection.

In many countries of the tropics, cattle are vaccinated against foot and mouth disease. The periodicity of vaccination and the type of vaccine used are decided by the veterinary authorities, but the A.H.A. plays a key role in the vaccination campaigns.

Lumpy Skin Disease
(Section 45)

Nature and Occurrence

A disease of cattle in southern, East and West Africa, caused by a virus, and thought to be spread by insects.

Symptoms

A rise in temperature is followed by the animal going off feed and developing a nasal discharge and running eyes. This is followed by the appearance of characteristic lumps or nodules in the skin. These vary in number and may be found all over the body but are usually around the muzzle and eyes, on the neck, back, legs, and on the brisket. The disease is most severe in European breeds, in calves and lactating cows.

The nodules vary from 0.5 to 5 cms in diameter, the hair on them standing upright.

The nodules tend to get bigger and may join with others forming one large nodule. The nodules become hard, separate away from the hide and tissues leaving sores and wounds.

Swelling of the legs, dewlap, udder and scrotum (caused by fluid) and enlargement of lymph nodes may occur.

Yellowish grey nodules producing pus may be present in the mucous membranes of the mouth. The animal may drool from the mouth. Difficult breathing may result from infected lesions in the respiratory tract.

Animals steadily lose condition, milk yields diminish and infection of udder may occur. Abortions frequently occur, and sterility may result.

The hides of animals infected are frequently rendered valueless.

Diagnosis

Diagnosis is generally based on the characteristic nodules and lumps. It is fairly easily distinguished from other skin diseases such as mange (Section 70) and dermatophilosis (streptothricosis) (Section 39).

Treatment, Control and Prevention

Treatment is not effective, although antibiotics and sulphonamides will deal with secondary infection, that is infections resulting from organisms arising other than the original virus.

Vaccination is effective in preventing the disease.

Malignant Catarrh

(Section 46)

Nature and Occurrence

An infectious and fatal disease of cattle and buffaloes caused by a virus. Sheep, goats and wild ruminants do not show symptoms but are thought to spread the disease, particularly at time of parturition. Wildebeeste (connochaetini or gnu) appear to be particularly involved when, in certain areas of Africa, the disease is present.

The disease occurs in many tropical and temperate countries, but economically is more important in Africa, Asia and Latin America.

Symptoms

Symptoms vary, but include watery discharge from nose and eyes which eventually becomes thick and muco-purulent; inflammation of the mouth; high temperature; loss of condition and emaciation; difficulty in breathing; opacity of eyes and sometimes blindness; skin lesions with peeling and thickening of skin. The lymph nodes on the outside of the body are clearly seen to be swollen.

In some cases constipation occurs, followed by diarrhoea, which is often bloodstained.

Nervous symptoms with paralysis appear before death, which occurs in the great majority of cases.

Post-mortem examination shows inflammation and discharges in the nasal tract; inflammation and ulceration of the oesophagus and stomach and swelling of kidney, liver, lymph nodes and spleen.

Diagnosis

Diagnosis is based on the history, symptoms and post-mortem lesions.

Confirmation of the disease can be obtained from affected tissues (brain, liver, spleen and kidney), sent to the laboratory in 10% formol-saline.

Treatment, Control and Prevention

No treatment. Cattle and domestic buffaloes must be kept separate from wild game, sheep and goats.

Mucosal Disease and Bovine Virus Diarrhoea
(Section 47)

A number of diseases are included in the above term caused by different viruses and referred to as bovine virus diarrhoea (BVD), bovine rhino-tracheitis (IBR) and stomatitis.

Nature and Occurrence

These diseases, which are very similar clinically, occur in one or more forms in many countries of Africa, Asia and Latin America in cattle, buffaloes, camels and wild animals.

Symptoms

Although they cause inflammation of the nose and mouth, diarrhoea and even death, these diseases are generally mild. They are important because they can be confused with rinderpest, foot and mouth disease and malignant catarrh.

At post-mortem examination, lesions similar to those seen in rinderpest and foot and mouth disease may be apparent.

Diagnosis

Differentiation between mucosal disease, rinderpest and foot-and-mouth disease can only be done in the laboratory. It is, therefore, important to send specimens to the laboratory so that these important diseases can be eliminated.

Treatment, Control and Prevention

Treatment is not effective. Vaccines have been produced, but are not generally used.

Rabies (Hydrophobia)
(Section 48)

Nature and Occurrence

A fatal disease which affects the nervous system of all mammals and man, caused by a virus which is generally transmitted in the saliva of affected carnivores (i.e. meat-eating animals). Dogs, foxes, hyenas, jackals and mongooses are important transmitters, while in Latin America, the vampire bat spreads the disease widely wherever it occurs, mostly cattle being affected.

Symptoms

The incubation period is usually 3-8 weeks, but this period may be up to 6 months, depending upon the nearness of the site of inoculation to the brain. The first symptoms in dogs are marked changes in the behaviour of the animal. Quiet animals become nervous and aggressive or wild animals may approach human beings. After some 4-5 days and before dying, the animal may develop either the "furious" type of rabies, or the "dumb" type.

In the "furious" type, the main feature is that the animal runs about madly biting anything in its path. Its throat becomes paralysed so that saliva drools from the mouth. The conjunctiva of the eye turns deep red.

In the "dumb" type, the animals' jaw and limbs become paralysed, saliva drools from its mouth and it seems as if a bone has stuck in the throat. No attempt should be made to examine the throat if rabies is suspected.

Although sometimes seen in dogs, dumb rabies is more usual in herbivores where paralytic rabies is the usual type.

In a few days, cases both of "furious" and "dumb" rabies become paralysed and die. If an animal is still alive 10 days after symptoms commence, the disease is almost certainly not rabies.

In cattle, sheep and goats, the animals become restless and excited; they may bite themselves - the voice changes - grinding of the teeth occurs - there is drooling of saliva and weakness of the hindquarters. The animal finally becomes paralysed.

If rabies is suspected, the animal should be confined in a strong cage or pen and allowed to die so that the brain can be examined undamaged and the diagnostic features which appear in the brain will be more developed.

Diagnosis

This depends on symptoms and laboratory examination of the brain.

No post-mortem of suspected animals should be made without wearing rubber gloves (plastic bags might be useful if no rubber gloves are available) and ideally, goggles to protect the eyes from splashes. If by error a post-mortem is made without gloves, the case later being confirmed, the A.H.A. should report at once to a doctor so that anti-rabies treatment can be taken.

For laboratory confirmation, the brain is removed. This is best done by the use of a saw through the head longitudinally along the central line, each half of the brain being removed. One half should be placed in a jar containing 50% glycerine and the other in a jar containing Zenker's solution or 10% formalin. (See Figure 49 and Appendix 11.)

If a saw is not available, an axe or machete can be used to cut the skull across the front and back and the plate of bone covering the brain levered off. The brain is then removed whole and dealt with as above.

Although the rabies virus cannot be seen under an ordinary microscope, it causes the appearance of certain bodies in the brain cells called "Negri bodies", and these can be seen if the brain is correctly stained. Other tests can also be made in the laboratory to confirm the presence of the disease.

After the brain has been taken out, the carcase must be safely disposed of and all the tools and instruments used thoroughly disinfected.

Some countries infected with the disease have specially printed report forms which the A.H.A. must fill in and send with the specimens.

Control and Prevention

There are efficient vaccines for all animal species and man. In some countries where rabies is present, dogs must, by law, be vaccinated at 3 months old; again at 9-12 months old and thereafter, every 1 or 3 years. In such countries, dogs must not be moved without a veterinary permit.

In some countries also, vaccination campaigns are carried out which involve not only the vaccination of all dogs, but the tattooing of all owned dogs and the shooting or poisoning of all stray dogs.

Unvaccinated dogs which have been in contact with rabid dogs should be destroyed, unless they can be vaccinated and adequately quarantined for 3 months.

If an apparently healthy dog in a rabies area bites a person, it should be tied up or confined for 10-14 days and placed under observation. If by then, it has not developed rabies, it can be released.

For cattle, sheep and horses, special vaccines are available. These are generally used only in the case of outbreaks, although in Latin America, it is necessary to vaccinate all cattle in certain areas.

For humans, a good vaccine is available which is used to protect persons such as A.H.A's who may have been in contact with, or bitten by a rabid dog or even a suspected rabid dog. Any person who has, over the previous 7 days, been in contact with an animal found to be rabid, should at once request vaccination from his doctor or health centre.

Rift Valley Fever

See Section 92 included under Diseases of Sheep and Goats.

Rinderpest, or Cattle Plague
(Section 49)

Nature and Occurrence

A highly infectious and usually fatal disease of cattle, buffaloes, pigs and other cloven hooved animals, caused by a virus. Historically, rinderpest has caused vast epizootics which have swept across Africa and Europe, killing millions of animals. At present, the disease is confined to West and East Africa, the Near East and Asia.

It is spread by the faeces and the expired breath of infected animals.

Symptoms

The incubation period is 3-15 days. Principal symptoms include: high temperature; loss of appetite; discharge from eyes and nose; staring coat; coughing; diarrhoea; red patches in nostrils and mouth, developing into shallow ulcers; grinding of teeth; loss of condition and death between 6 and 12 days or recovery.

Post-mortem examination shows an emaciated carcase, with the mouth, pharynx and vagina greatly inflamed and having rough areas covered by a membrane or even ulcers. The mouth has a characteristic smell.

The abomasum is intensely inflamed and ulcerated. There are congested areas and haemorrhages in the intestinal and rectal walls; the liver and spleen may be swollen and filled with blood, and the lungs may be congested.

Infected animals may sometimes succumb to redwater (as a result of lowered resistance) in which case, the urine in the bladder may be red.

Diagnosis

Rinderpest may be confused with malignant catarrh (Section 46), but the diarrhoea and intestinal lesions are rarely seen in that disease, which is also characterized by enlarged lymph nodes, which are not seen in rinderpest.

Treatment, Control and Prevention

Treatment is not effective.

Where the disease is enzootic, all susceptible animals must be vaccinated. A vaccine made from the virus is now the most commonly used ("tissue culture") vaccine (TCV). This vaccine gives a life-long immunity. In all areas to which rinderpest may spread all calves on reaching 6 months of age must be vaccinated. If this is not done, a large, highly susceptible cattle population builds up in which rinderpest can quickly spread causing heavy losses and keeping the disease going in the region concerned.

In areas where wild game is present, it may be difficult, if not impossible, to eliminate the disease, and annual vaccinations must be undertaken without fail.

Ephemeral Fever (Three Day Sickness)
(Section 50)

Nature and Occurrence

A non-contagious virus disease of cattle in many tropical and sub-tropical countries thought to be spread by small sand-fly-like insects. In Africa, it is most often seen in imported animals and European breeds during the rainy season.

Symptoms

Symptoms include sudden occurrence of high temperature; dullness; nasal discharge; enlarged lymph nodes; lack of appetite; stiffness and lameness, the affected animals lying down. Milk production is reduced, the milk being watery and sometimes with blood in it.

Adult animals suffer more than young animals. While morbidity may be high, mortality is very low, most cattle recovering after a few days.

Treatment, Control and Prevention

No treatment is available. Vaccination can be undertaken, but the advice of the Veterinarian on this should be followed.

Cow Pox
(Section 51)

Nature and Occurrence

One of a number of diseases in different animals known as the "pox" diseases, caused by a group of viruses which attack the cells of the skin. Cow pox is usually spread during milking of dairy cattle. The vaccine used against human smallpox (now eradicated throughout the world) was made from a strain of cow pox.

Symptoms

Cow pox affects the hairless parts of the body, chiefly the teats, and the sides of the udder. Blisters, containing a yellowish fluid, form on these sites which soon break, leaving holes which fill with pus. Scabs eventually form, the blisters heal, the scab falls off and the characteristic "pock" marks are left.

The lesions on the teats prevent calves suckling, and milking the cows is difficult.

Sheep pox is a more severe disease, and is dealt with in Section 88.

Treatment, Control and Prevention

Treatment consists of keeping the lesions clean and dressing them with an ointment.

Vaccination against pox diseases in animals is not practised.

CHAPTER 7

DISEASES OF CATTLE AND BUFFALOES CAUSED BY PROTOZOA AND RICKETTSIA

(1) Ticks and the Tick-borne Diseases

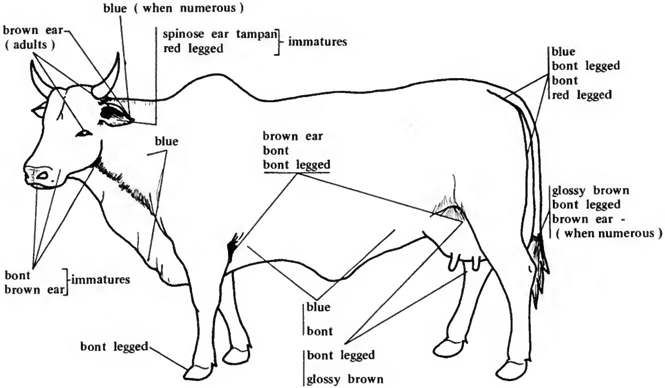
General
(Section 52)

Tick-borne diseases differ from many other diseases in that young animals are more tolerant than older animals to most of these diseases because they have a degree of protection derived either from their dams or from resistance naturally possessed by young animals.

Thus, in areas where these diseases and their vectors (i.e. carriers of infective agents from one host to another) occur, animals exposed to a sufficient number of infected ticks are infected early in their life, suffer a relatively mild infection, usually recover and grow up resistant to further infection. They remain, however, carriers of the disease organism.

If complete tick control cannot be achieved in an area, calves need to be exposed to moderate numbers of infected ticks so that they can acquire infection at an age when they suffer little but have resistance to later infections.

In areas where tick control is good, or where certain tick species are not present, calves will grow up either completely, or partially susceptible to tick-borne diseases.



(See sections 52 - 64)

Fig 20 - PREDELECTION SITES OF THE ECONOMICALLY IMPORTANT CATTLE TICKS.

If tick control in such areas breaks down, or the susceptible animals from these areas are moved as adults to areas where infected ticks are present, these adult animals will suffer severe losses.

This explains why severe losses of adult animals are experienced following the movement of animals (nomadic or trade animals) into areas where tick species different to those in their home areas are present or when routine tick control can no longer be achieved for one reason or another.

With a better understanding of the disease process, and the development of an improved range of drugs, it is now becoming possible to vaccinate and treat most of the tick-borne diseases.

Ticks
(Section 53)

To understand the various diseases transmitted by the bites of infective ticks it is necessary to know something of the ticks which transmit these diseases.

In many developing countries, especially those in tropical and sub-tropical countries, the tick-borne diseases represent the greatest threat to the development of the livestock industry. One of the reasons for this is the continuous warm weather of these countries which ensures that tick populations are maintained at high levels.

Each tick infesting an animal may suck out some 0.3 ml of the animal's blood. Even in animals such as the zebu breeds, which are resistant to ticks, this may have a serious effect when the animal is suffering from a low level of nutrition or is pregnant.

Ticks have four pairs of legs with an undivided round or oval body with no division between head, thorax and abdomen, unlike insects.

The tick family is divided into two groups - 'soft' ticks, which infest birds and 'hard' ticks, which infest almost all animals and man.

The hard ticks (or Ixodid ticks) have a hard shield covering the whole upper surface of the male and covering a small area behind the mouth parts in the female. From the colour and certain other characteristics of this shield ticks can be identified and classified.

There are four stages in the life cycle of ticks - the egg, larva, nymph and adult.

When the female tick has mated and engorged itself with blood from an animal, it drops to the ground where it lays 2,000 to 20,000 eggs depending on the species. It then dies.

The eggs hatch out in 2-10 weeks, depending on the species and the weather.

The larva (small tick with 3 pairs of legs) climbs up the grass and attaches itself to a passing animal on which it feeds. When engorged, it drops off and changes into a nymph, except in the case of one host ticks (see below) where it stays on the animal.

Fig 21 - THE LIFE CYCLE OF A ONE HOST TICK. (See section 53)

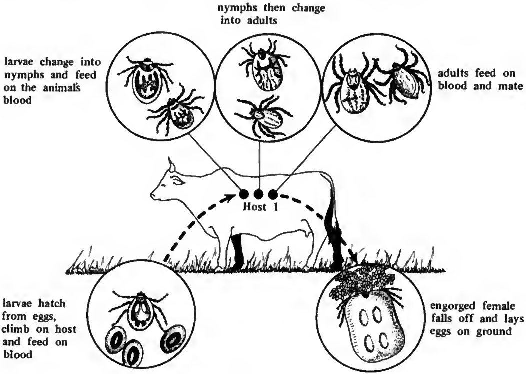

nymphs then change into adults
larvae change into nymphs and feed on the animal's blood
adults feed on blood and mate
Host 1
larvae hatch from eggs, climb on host and feed on blood
engorged female falls off and lays eggs on ground

Fig 22 - THE LIFE CYCLE OF A TWO HOST TICK. (See section 53)

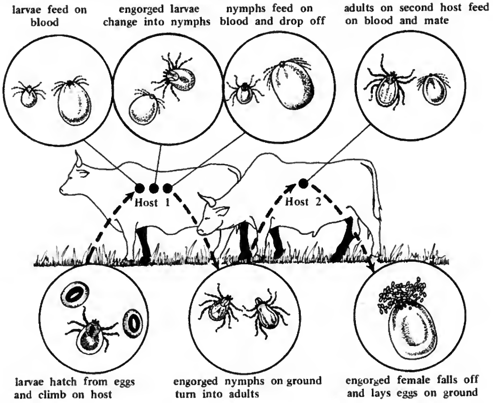
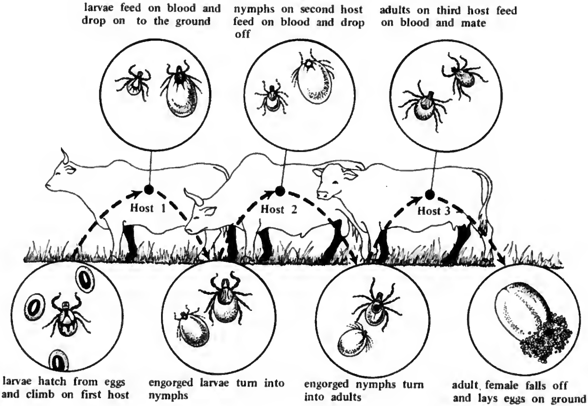

larvae feed on blood
engorged larvae change into nymphs
nymphs feed on blood and drop off
adults on second host feed on blood and mate
Host 1
Host 2
larvae hatch from eggs and climb on host
engorged nymphs on ground turn into adults
engorged female falls off and lays eggs on ground

Fig 23 - THE LIFE CYCLE OF A THREE HOST TICK. (See section 53)


larvae feed on blood and drop on to the ground
nymphs on second host feed on blood and drop off
adults on third host feed on blood and mate
Host 1
Host 2
Host 3
larvae hatch from eggs and climb on first host
engorged larvae turn into nymphs
engorged nymphs turn into adults
adult, female falls off and lays eggs on ground

The adult attaches itself, engorges and, if a female, drops off and lays its eggs.

Depending on how often in their life cycle they drop off from the host animal, ticks can be divided into 3 types:

(i) One Host ticks where all stages are spent on the same animal. (See Fig. 21.)

(ii) Two Host ticks where the larval and nymphal stages are spent on the same animal, the nymph dropping off to change into the adult which then infests another animal. (See Fig. 22.)

(iii) Three Host ticks which at each stage drop off to change, each stage of tick attaching itself to a different animal. (See Fig. 23.)

It is important to know in controlling ticks whether the tick concerned is a One, Two or Three Host tick.

Ticks are generally controlled by the immersion of animals in, or the application to them in a spray, of an acaricide, a chemical capable of killing the ticks.

A one host tick stays on the animal longer and dipping intervals can be longer than in the case of two host and three host ticks, which need shorter interval dipping. The strength of the dips can also be varied.

Tick Infestation and its Effects
(Section 54)

Ticks in general are not very specific for their hosts, although this is not always the case. They usually show, however, a preference for certain areas on the host, such as the head, ears, anal region, udder, dewlap, scrotum, etc.

Heavy tick infestation causes loss of condition; varying degrees of anaemia; a scabby corrugated condition of the animal's skin sometimes followed by suppuration, damage to and reduced value of hides and skins. Of greater importance is that ticks transmit a number of serious diseases.

In the tropics and sub-tropics, common diseases of which ticks are the vectors (carriers) include:

Theileriosis	(East Coast fever, Corridor disease, Mediterranean fever, etc.)
Anaplasmosis	(Gall sickness)
Babesiosis	(Redwater)
Cowdriosis	(Heartwater)
Nairobi Sheep Disease	
Spirochaetosis	

In addition to the diseases of which ticks are the vectors, the loss of blood they cause and the secondary infection that often arises from their bites, certain ticks may also cause conditions called tick toxicosis or tick paralysis. These are neither caused by a micro-organism nor a protozoan but by toxins.

Sweating Sickness in calves in Africa and paralysis in most domestic animals in tick-infested areas are forms of tick toxicosis.

Tick Species
(Section 55)

Some of the most common species of ticks found in tropical and sub-tropical regions, and grouped in accordance as to whether they are "Hard" ticks (Family - Ixodidae) and whether in this Family they are One Host, Two Host or Three Host ticks or "Soft" ticks (Family - Argasidae) are listed below.

"Hard" ticks (Family - Ixodidae)

One Host - Genus: Boophilus

Species No. 1 - B. decoloratus (Blue tick)

Found on - cattle and other mammals
Countries - common in southern, eastern and central Africa,
- central and S. America
Diseases Transmitted - Babesiosis, anaplasmosis of cattle, spirochaetosis

Species No. 2 - B. annulatus

Found on - many mammals
Countries - Egypt, western Asia, Central America
Diseases Transmitted - Babesiosis

Species No. 3 - B. microplus (cattle tick)

Found on - cattle
Countries - Tanzania, Malagasy Republic, tropical America, Mexico, Australia, S.E. Asia
Diseases Transmitted - Babesiosis, anaplasmosis, theileriosis

Two Host - Genus: Rhipicephalus

Species No. 1 - R. evertsi (red-legged tick)

Found on - cattle, sheep, goats, large wild animals, horses
Countries - Africa, central and southern
Diseases Transmitted - East Coast fever, babesiosis, spirochaetosis

Species No. 2 - R. bursa

Found on - cattle and other mammals
Countries - Africa, South East Asia, elsewhere
Diseases Transmitted - Babesiosis, anaplasmosis, theileriosis, rickettsiosis

Genus: Hyalomma

Species No. 1 - H. truncatum (African bont legged tick)

Found on - cattle, sheep and birds

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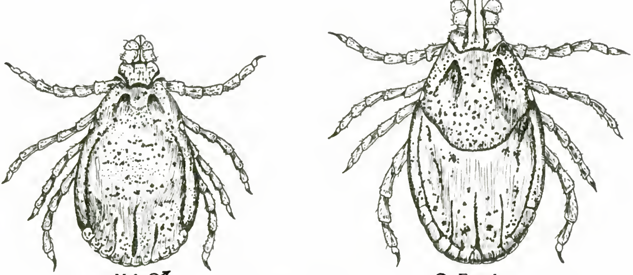
Fig 24 - THE BROWN TICK (Rhipicephalus appendiculatus) THE CHIEF TRANSMITTER OF EAST COAST FEVER.



Male ♂

(See section 55)

♀ Female

Countries - Africa
Diseases Transmitted - Sweating sickness in calves

Species No. 2 - H. rufipes (large bont legged tick)
Found on - cattle, sheep and other mammals
Countries - Africa, west Asia, USSR,

Diseases Transmitted - abscesses

Species No. 3 - H. dromedariae (camel tick)
Found on - camels
Countries - Africa north, Asia
Diseases Transmitted - Theileriosis due to T. annulata

Three Host - Genus: Rhipicephalus

Species No. 1 - R. appendiculatus (brown ear tick)
Found on - cattle, goats, other mammals, horses (prefer inside ears, eyelids, tail brush)
Countries - Africa, east, central and south (not west)
Diseases Transmitted - Main vector of East Coast fever (Theileria parva); Corridor disease, babesiosis, spirochaetosis, Nairobi sheep disease

Species No. 2, 3, and 4 - *R. simus, R. pravus, R. capensis*

Found on - cattle
Countries - Africa
Diseases Transmitted - East Coast fever (*R.simus* also transmits anaplasmosis)

Genus: *Amblyomma*

Species No. 1 - *A. hebraeum* (the bont tick)
Found on - cattle, many mammals, birds
Countries - Tropical regions
Diseases Transmitted - Heartwater, tick bite fever (*Rickettsia canorii*), septic lesions

"Soft" ticks (Family - Argasidae)

Genus: *Argas*

Species No. 1 - *A. persicus* and *A. walkerae* (fowl tick - tampans)
Found on - fowl, turkeys, ducks, geese, pigeons, ostriches, some wild birds
Countries - Tropical regions
Diseases Transmitted - fowl spirochaetosis, *Aegyptianella pullorum* (protozoan); causes great restlessness in birds, anaemia, emaciation; egg laying ceases

Genus: Otobius

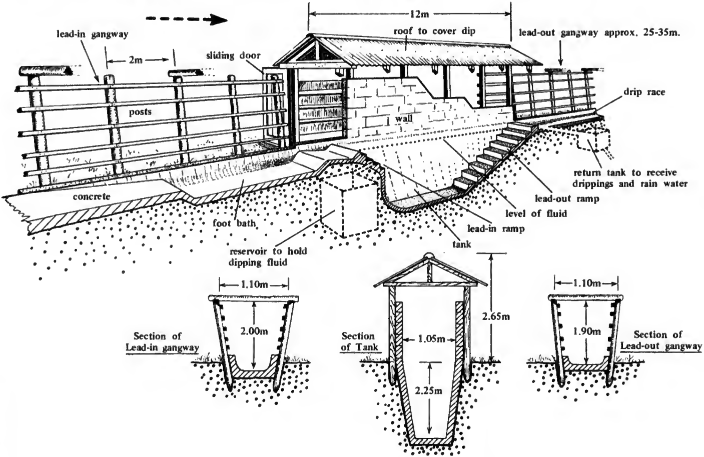
Species No. 1 - O. megnini (spinose ear tick)
Found on - cattle, sheep, horses, other animals
Countries - Africa north, Central and South America
Diseases Transmitted - Irritation, inflammation of ear; secondary bacterial invasion, anaemia, loss of condition, etc.

Genus: Ornithodorus

Species No. 1 - O. savignyi

Found on - Camels, poultry, sheep and other animals
Countries - Africa in sandy areas, India, Sri Lanka, Western Asia
Diseases Transmitted - Spirochaetosis in poultry, paralysis in sheep

Fig 25 - A DIP TANK WITH ONE SIDE CUT AWAY. (See section 56)



Tick Control
(Section 56)

Introduction

The A.H.A. will be closely concerned with tick control. In countries where there are Government-organized and supervised dipping operations, A.H.A's may be in charge of a dipping tank and the area it serves and may live at the tank. He will thus see the stock in his dip tank area regularly, will know the livestock owners and be able to report to his Veterinarian any outbreak of disease immediately it occurs.

The only effective way of controlling ticks and the diseases of which they are the vectors, is by dipping animals in, or spraying them with, an acaricidal fluid, i.e. a fluid containing a chemical which kills ticks.

Dipping

The plunge dipping tank is the most efficient, practical and convenient means of controlling ticks by chemical means. Dipping tanks must have been carefully constructed to an approved and standardized design so that

(i) animals can easily plunge in and walk out of the tank;

(ii) they are completely wetted, and

(iii) the excess acaricidal fluid can drip from the animals in the exit race and the draining pen back into the tank.

The animals are first assembled in a collecting pen with a gate so that they cannot escape, and where they can drink. They are then driven into the tank entrance race which is made so narrow that the animals cannot turn round and the sides so high that they cannot see over. The entrance race should have a footbath built into the floor to remove mud from the feet before the animals enter the tank. The animals walk up steps out of the tank into the exit race which has a sloping floor from which the dripped tank fluid returns to the tank. The animals then move to the draining pen which also has a sloping floor from which the last drops of the dip fluid are collected, pass through a sump, which filters off dirt and straw, etc., and returns it to the dip.

For large numbers of cattle, tanks will have a capacity of 13,500 - 16,000 litres, while for small herds they will have a capacity of around 9,000 litres.

The dipping tank must be protected from rain water, which would dilute it, and be securely fenced off to prevent animals having free access to it, the dipping tank fluid, the soak-away pit into which the tank debris and dirty dip wash is put when the tank is cleaned out, and the surrounding area.

The tank must have collecting and draining pens, a calf pen, and a foot bath. It should be of known capacity (say 2,000 litres) so that known amounts can be added to the dip tank. It must have a locked store in which the acaricide can be kept.

The drainage race should be constructed with a crush so that it allows only one animal at a time to pass and enables animals to be hand-dressed, treated for screw worm and given inoculations, etc.

Each tank will have a calibration stick for measuring the fluid in the tank; a one-litre measure; a pre-mix bucket; a crooked stick to support young or weak animals, a counter and a record book.

Operation of Dipping Tank

Being in charge of a dipping tank is a responsible position and the A.H.A. should continuously keep in mind the following points:

1. As far as possible dipping (or spraying) should be avoided on wet and cold days.

2. Cattle should not be dipped when in a heated condition. They should be cooled off and given water to drink before dipping, otherwise they may drink dip fluid and poison themselves.

3. Cattle should be dipped in the mornings and after they have dripped they should be driven away quickly; they should not be kept standing for long periods in yards.

4. The heads of cattle should be well immersed otherwise ticks will not be killed.

5. The dip fluid must be kept at the correct strength otherwise ticks which are resistant to the acaracide will survive to breed.

6. The dip should be regularly cleaned out once or twice a year and surface debris skimmed off after every dipping.

7. All concrete flooring should be kept clean; special attention should be paid to foot baths, especially if water is not flowing through them. If the walk-in race has a metal grid in it this should be frequently cleaned out.

8. Small and large animals should not be dipped together - large animals will jump on the smaller. Pregnant animals just before calving should be sprayed but not dipped.

9. Cattle should enter the dip slowly one at a time. Care must be taken to ensure that cattle can walk freely out of the tank. If they get blocked at the exit some animals may drown.

10. With suspension type dips the first 20 head which pass through should be re-dipped while still wet. The object is to stir the dip and bring up active material which may have settled on the bottom.

11. A worker should always stand by while cattle are being dipped to count the animals and to ensure that they pass

through the dip without difficulty. He should have a long hooked stick to help animals in difficulty and should stop animals entering if others get into trouble.

12. Cattle should be allowed to drip thoroughly before being driven off or they will poison the pasture on their way from the tank.

13. A calf can be withheld from dipping only for one dipping after it is born. Calves can be helped through the tank with a crooked stick; they should not be dipped with adult animals.

14. If the Veterinarian instructs the A.H.A. to do so the cattle should be hand-dressed after being dipped.

15. Dipping records must always be carefully kept.

16. The dipping fluid must always be kept under lock and key. If an animal is poisoned from an arsenic dip it should be given 50-100g. (2-4 oz) sodium thiosulphate in half a litre of warm water. This chemical should always be kept at tanks using arsenic.

17. If the dipping fluid is made up of organic phosphates, atropine sulphate must be kept at the tank - it is the antidote to this acaricide and is given by injection. Symptoms may

include salivation, stiffness of the hindquarters, muscular trembling, gasping with mouth open and diarrhoea which may be blood tinged.

Measuring Tank Capacity

In dipping cattle it is very important to know the capacity of the dipping tank so that the correct amount of acaricide can be added to the tank when charging the tank on first filling, when replenishing it with acaricide and water (topping up) or when reinforcing the dipping fluid with acaricide alone.

The dipping tank should be marked so as to show how much dipping fluid there is in the tank up to its working level. This can be done when it is filled by counting the number of drums of water needed to fill it and marking the wall or using a measuring stick at intervals.

There are a number of methods of measuring the amount of dipping fluid in a dipping tank and in maintaining an effective and uniform strength of active chemical in the tank. The A.H.A. must follow strictly the instructions of his Veterinarian in this work.

The following points are of special importance:

1. The maintenance of the dipping fluid at the correct strength is of prime importance. Heavy rain, hot dry weather causing evaporation or a leaky tank, as well as normal loss of fluid on the dipped animals, will alter the strength of the dip.

2. Dirt and hair in the dipping fluid adversely affects its strength and should be skimmed off with a wire scoop when it appears. Dirt will sink to the bottom as sludge and this should be removed with a long-handled shovel 1-2 hours after dipping. Removing sludge removes acaricide and the dip should be tested after this.

3. The dip fluid should be stired before dipping to make sure the acaricide is well distributed throughout the fluid. An inclined board dragged along the bottom with a rope can be used for this purpose, or the first 20 head passing through the dip can be re-dipped.

4. Sampling of the dip fluid for its analysis is a very important duty of the A.H.A. If arsenic is being used this can be tested at the dip by the A.H.A. but this is now rarely used and other acaricides must be tested at a laboratory.

   Instructions for taking and despatching samples to the laboratory and for testing, if arsenic is being used in the dipping tank, will be found in Appendix 13.

5. To enable the strength of the dip fluid to be kept at the correct level, the A.H.A. must keep good records. In any case this is necessary to ensure that all the cattle of the dip tank area are being dipped.

Suitable headings for a dip tank record are:

Date

Dip volume at start of dipping

Volume of water added

Volume of acaricide added

No. of cattle dipped

Dip volume at end of dipping

Results of analysis

Notes

Maintaining Dip Fluid Strength

The method of correcting the dip strength in the case of flooding, leaking, evaporation or use, is:

1. After each dipping the level of the dipping fluid is recorded.
2. Before the next dipping the level is checked and compared with the level after the previous dipping.
3. If the level has fallen (because of evaporation) water is added to bring the level up to the level at the previous dipping unless the Veterinarian instructs otherwise.

4. If levels of fluid are consistently low this indicates a leak. The dip should be emptied and repaired.

5. If the level has risen because of rain entering the dip, it should be pumped out until the correct level is reached. A sample is taken and when the results of the analysis arrive the strength of the fluid is adjusted.

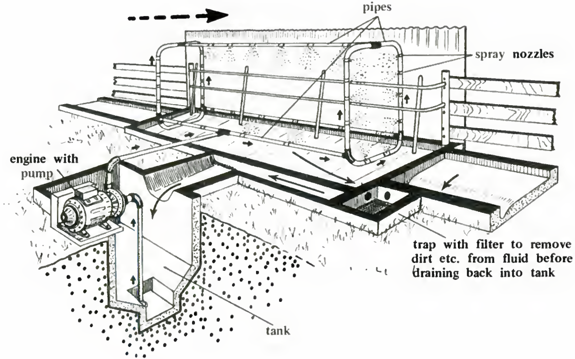
6. Losses of dip fluid due to fluid being taken out by animals can be corrected after analysis or according to instructions supplied by the manufacturer.

7. In bringing the dip tank fluid up to strength the A.H.A. will follow the instructions sent with the analysis from the laboratory or given by the Veterinarian. In an emergency (absence of Veterinarian or of the analysis from the laboratory) A.H.A's can read and follow the instructions of the manufacturers on the label of the container of the acaricide being used.

Spraying

In some countries power spraying is used instead of dipping. If this is done under a Government-controlled scheme it can be as effective as dipping and does not require such an elaborate system of fluid analysis. In such cases crushes take the place of dipping tanks and spraying with power sprays is done by trained A.H.A.'s using the new insecticidal preparations.

Fig 26 - A SPRAY RACE WITH WALL REMOVED ON ONE SIDE TO SHOW DRAINAGE OF FLUID. (See section 56)


pipes
spray nozzles
engine with pump
trap with filter to remove dirt etc. from fluid before draining back into tank
tank

Spraying can be done with hand sprays but this may lead to serious difficulties in later years if it is not thoroughly supervised.

A spray race is a permanent structure, open at both ends in which a race and crush are placed and in which cattle passing through, are sprayed with acaracide pumped at low pressure but in large volume through nozzles with large orifices, placed at different locations inside and along the race.

Excess spray fluid drains from the race, passes into a tank, is filtered and is used again. Spray races are economical in the fluid they use and are quick. However, the engine, filters, pumps and nozzles etc. need maintenance and spares are not always easy to obtain. For most countries dipping tanks are preferable since the cattle dip themselves.

In operating power spray races only liquid synthetic acaricides should be used not wettable powders and not arsenic. A pressure gauge should be fitted and spraying carried out at the pressure recommended. Some power sprays can be operated from power take-offs fitted to vehicles.

Cattle should be handled quietly and allowed to go through the race at their own speed - they will then usually lift their tails. To ensure the spray thoroughly wets inside the ears and the tail brush, these should be trimmed of any long hair.

Once cattle have become used to power spraying some 600 head can be sprayed each hour. For 500 head, 1,600 litres of dip wash will be needed and 500 - 600 litres will be left at the end, but this should be thrown away after spraying as it will be very dirty.

Hand Spraying

Hand spraying is sometimes used but this must be done very thoroughly by well trained personnel. All parts of the animal (including hidden parts) must be sprayed. Animals have to be tethered at posts or held in a crush or race so that spray nozzles can be held close to animals.

Ten litres of spray fluid are needed for each animal. Spraying must be done systematically as follows:

1. First the hooves, under-parts at rear of animal, under tail, the scrotum or udder and inside legs are thoroughly wetted.

2. Belly, sides and back of animal are then sprayed.

3. The front legs and up into the armpits follow.

4. Finally, the head and neck, with special attention being paid to inside the ears, are thoroughly sprayed.

Hand spraying is laborious and not so effective as the dip or power spray. It should not be used for herds of more than 10 head.

Hand-dressing

If after dipping or power spraying ticks are found in the ears or under and around the base of the tail it may be necessary to apply acaricide by hand.

Dip or spray fluids can be applied with a swab or sponge or specially formulated acaricides in oil or liquids applied with a brush, squeeze bottle, or grease gun.

Acaricides can be made up in powder form and sprinkled or applied with a squeeze bottle or dusted on using an old sock filled with the powder.

Frequency of Treatments

If tick control by the methods described above is to be effective, application of the acaricide must be at certain intervals in accordance with the life cycle of the tick species being controlled, the kind of acaricide being used or the purpose of the treatment, i.e. whether to eradicate ticks or reduce the tick population to a level below which it does not cause harm.

The Veterinarian will consider all these factors and decide on the dipping or spraying intervals to be applied.

Acaricides

There are many different acaricides. This is mainly due to the fact that in all areas where acaricides have been used, new acaricides have had to be found because, after a time, the ticks have become resistant to the old ones which are then no longer effective.

This was the case with arsenic, one of the first acaricides to be used which had the great merit of being cheap. It is still being used in certain limited areas but is not now recommended.

Other acaricides in use include those such as lindane and toxaphene (the chlorinated hydrocarbons); coumadioxathion and diazinon (the organo-phosphates); carbaryl and armitroz (the carbamates) and a new group of acaricides called synthetic pyrethroids.

The A.H.A. will be issued with the appropriate acaricide by his Veterinarian but he may hear the names of others such as those mentioned above.

Most acaricides do not dissolve in water but are accompanied by agents which make them disperse evenly throughout the dip fluid. They must therefore be carefully mixed.

Liquid chemicals are mixed by adding small quantities to 20 litres of water and stirring well. This creates a fine emulsion which spreads evenly throughout the dip fluid.

Chemicals in powder form are first mixed with water to make a paste, then with more water to make a thin cream, which is added to the dip.

Chemicals in paste form are heated until melted and the liquid poured into the dip. No other agents or material should be added since the effectiveness of the acaricide being used may be adversely affected.

A.H.A's must remember that all acaricides are poisonous to man and animals. Great care must be taken therefore in their use, especially when handling them in concentrated form. The following rules should always be followed:

1. Acaricides should be mixed in an open, well-ventilated place.

2. Acaricides should not be spilt on skin or clothes. If they are, the skin should be washed immediately and the clothes changed.

3. Rubber gloves and, if necessary, respirators should be worn when handling the concentrated acaricide. The manufacturer's label on the container will have instructions regarding use of a respirator or protective clothing. These instructions should be read and followed without fail.

4. When using acaricides, the A.H.A. should not smoke, eat or drink.

5. After using acaricides the A.H.A. should bath and change his clothes which should be washed before being used again.

6. Acaricides should always be stored in their original containers which should be destroyed when empty. Such containers can be dangerous and should not be given out as water containers or for other use.

7. Acaricides should never be stored with other chemicals or food and must be kept out of reach of children, animals or unauthorized persons.

East Coast Fever (ECF)
(Section 57)

Nature and Occurrence

A serious, non-contagious disease of cattle, caused by a protozoal parasite, *Theileria parva*, transmitted by the tick *Rhipicephalus appendiculatus* (the "brown tick") a three host tick (see Section 55) found in those areas of Africa where rainfall and temperature are suitable for its survival. The parasite is one of a number of parasites in the genus Theileria, hence the various diseases they cause are called theilerioses.

Symptoms

An infected nymph or adult tick bites an animal which develops symptoms of the disease 10-25 days later. The animal is dull and listless, with a temperature of about 41.5°C (107°F). Very characteristic are the swollen lymph nodes, especially those below the ears, in front of the shoulders and stifle joints which are very obvious. Breathing becomes difficult as the disease progresses. The animal coughs and develops a profuse, clear nasal discharge. It rapidly becomes weak, lies down and dies about 12 days after symptoms start.

Animals which have grown up in an ECF area may have survived a number of attacks as calves and become immune. But the death rate in introduced animals from a non-ECF area (especially exotic cattle) will be up to 100 percent.

The most characteristic post-mortem lesion is a collection of fluid (oedema) in the lungs. Other lesions normally include large and haemorrhagic lymph nodes, ulcers and haemorrhages in the fourth stomach, and haemorrhages in the intestines and rectum (in lines). The kidneys show characteristic white spots while other organs are enlarged.

Diagnosis

Diagnosis depends on examination of blood, lymph node and spleen smears; A.H.A's must be sure to send smears from all three to the laboratory for examination if ECF is suspected and report this at once to the Veterinarian.

Treatment, Control and Prevention

Treatment with halofuginone or parvoquinone is effective if started early in the disease. These drugs are becoming increasingly available.

Intensive dipping, spraying and hand-dressing against ticks, ideally every five days, but in practice every seven days, can control the disease. In certain countries, e.g. Swaziland and South Africa, intensive tick control and enforcement of regulations have eradicated the disease.

Cattle moved into ECF areas must be subject to intensive tick control. Cattle from

ECF areas moved into clean areas must be quarantined for at least 25 days and subjected to intensive tick control with frequent examination of blood smears being made. If infection occurs the quarantine area should not be used for over 15 months and the cattle must not be permitted into clean areas.

Methods of immunizing cattle against ECF have been developed and are at present (1984) undergoing field trials in a number of countries. While such methods offer considerable promise, they still remain somewhat difficult to apply for field use and it may be some years before they are freely available.

Corridor Disease
(Section 58)

Nature and Occurrence

A non-contagious tick-borne disease primarily affecting wild buffaloes in Africa but transmissible to cattle. It is caused by a protozoan parasite Theileria parva lawrencei similar to Theileria parva the cause of East Coast fever.

Symptoms

Similar to ECF but generally less severe.

Diagnosis

Differentiated from ECF through the blood smears.

Treatment Control and Prevention

Treatment with drugs such as Halofuginone or Parvoquinone is effective.

Control depends on control of ticks and preventing contact between African buffaloes and cattle.

Animals recovered from disease are immune.

Heartwater
(Section 59)

Nature and Occurrence

An acute disease caused by rickettsia Cowdria ruminantium (not a protozoan) but transmitted by ticks of the genus Amblyomma ("bont" ticks) which are three host ticks. Cattle, sheep and goats are susceptible.

Symptoms

Symptoms which are similar in all species start 13-17 days after bite of tick.

Body temperature quickly rises to 41.5°C (107°F) or higher and sometimes animals die without further symptoms. There is often diarrhoea which is sometimes blood stained. The animal shows nervous symptoms, twitching muscles, movements of head; walks stiffly in circles; finally becoming so incoordinated that it falls down in a fit.

Indigenous cattle born and raised in infected areas are immune through exposure as calves but exotic high grade animals are very susceptible.

Although the nervous symptoms do not resemble those of rabies in ruminants, the possibility of this disease should always be borne in mind. The nervous symptoms may be confused with those due to cerebral babesiosis.

At post-mortem examination the sac round the heart will usually be found to be filled with yellowish fluid (from which the disease is named); fluid may also be found in the chest and sometimes the abdominal cavities. The spleen and liver are usually enlarged and haemorrhages may be present in the stomach, intestines, rectum, on the heart and kidneys and in the trachea. Fluid may be in the lungs.

Diagnosis

Diagnosis is confirmed by the finding of the organism in brain-crush smears. Blood, lymph node and spleen smears should also be sent for examination. If rabies is suspected half the brain should be taken and treated as a rabies specimen.

Treatment, Control and Prevention

Treatment with tetracyclines or sulphonamides is effective if given early enough. Vaccination by injecting infected blood and controlling the reactions with tetracycline drugs is effective but troublesome and would only be justified in the case of valuable exotic animals.

Control is by controlling "bont" ticks by regular dipping, spraying and/or hand-dressing.

Bovine Babesiosis (Redwater - Piroplasmosis - Tick fever - Texas fever)

(Section 60)

Nature and Occurrence

A tick-borne disease of domestic animals caused by protozoan parasites of the Genus Babesia characterized by red blood pigment in the urine.

In most tropical and sub-tropical areas the parasite in cattle is either B. bigemina or B. bovis carried by Boophilus species (blue tick) and others. There are other species of Babesia affecting horses, dogs, sheep and pigs which cause similar symptoms in these species.

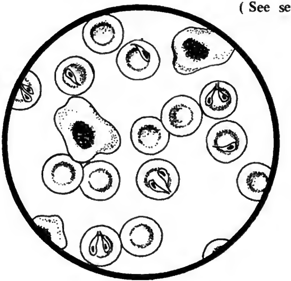
Symptoms

Symptoms are characterized by a sudden high temperature of 41°C (106°F) or higher some 8-17 days after the bite of a tick. Animal stops feeding, is dull with a staring coat; the mucous membranes become anaemic and later may be yellow. Breathing is quickened; heart beats very strongly and fast; and the animal may develop nervous symptoms which can be confused with rabies; it becomes weak and urine is often red. After 2-3 days the untreated animal may die or the disease may become chronic with digestive disturbances, colic and diarrhoea and eventual death.

In endemic areas where cattle are not dipped as calves, they acquire a form of immunity (premunity) to the disease. Adult dipped cattle or imported exotic cattle are very susceptible and will die unless treated.

Fig 27 - BABESIA, PEAR SHAPED ORGANISMS IN BLOOD CELLS, AS SEEN UNDER A MICROSCOPE IN SINGLES OR PAIRS.

(See section 60)



At post-mortem examination a very characteristic lesion is a large spleen. This must not be confused with anthrax in which, however, the blood is tarry and dark.

The carcase is anaemic, sometimes yellowish and the urine pink or red. The liver is enlarged, soft and, if cut into, may be orange in colour. Kidneys may be congested and haemorrhages may be present in the heart, stomach and intestines; sometimes there is froth in the air passages.

Diagnosis

Diagnosis is confirmed by blood smears which show babesia organisms. Brain crush smears should also always be made on post-mortem. Redwater responds well to a number of drugs and this fact helps to differentiate the disease from other diseases such as anaplasmosis and heartwater.

In tick-borne diseases more than one parasite may be present so blood, lymph nodes spleen smears and brain-crush smears should all be taken. If rabies is suspected, half a brain should be sent to the laboratory as a rabies specimen.

Treatment, Control and Prevention

Many drugs will cure redwater in the early stages such as Pirevan, Phenamidine and Imidocarb. These are easily injected subcutaneously and should be given according to the estimated weight of the animal.

In regard to control, this is based on the elimination of the tick vectors by dipping or spraying; control of stock movements; and the immunisation of animals susceptible to the disease. The Veterinarian will give instructions on all these points.

Animals recovering from an attack of the disease have a strong resistance to it. This is "premunity" to the disease and may last for up to 4 years.

Convalescent animals should receive additional feeding for some weeks. (See Section 130.)

Anaplasmosis - Gall-sickness
(Section 61)

Nature and Occurrence

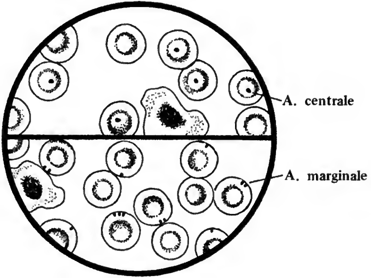
A non-contagious disease of cattle caused by a rickettsia (not a protozoan), a small organism found in the red blood cells and transmitted by ticks.

There are two forms of the disease, one a severe form caused by a micro-organism Anaplasma marginale and a less severe form caused by the micro-organism Anaplasma centrale.

Both parasites are transmitted mainly by blue ticks (Boophilus species) (Section 55). Other ticks and biting flies can spread the disease. Probably the use of unsterilized needles or instruments can also transmit the parasites.

Fig 28 - ANAPLASMA ORGANISMS (A. marginale and A. centrale)
AS SEEN IN THE BLOOD CELLS UNDER THE MICROSCOPE.

(See section 61)



Symptoms

The disease appears 30-40 days after the animal is bitten by an infected tick.

The body temperature is high (40°C) but not so high as in redwater. Animal is off feed; dull; constipated; mucous membranes are pale, then become yellow; urine darkish yellow but not red unless animal also has redwater; and lymph nodes are enlarged. Animals rapidly lose condition, the mortality rate being high, especially in mature animals, younger animals being less severely affected.

On post-mortem the carcase will be anaemic and yellow. The gall bladder will be greatly enlarged and filled with dark yellow bile. The spleen, liver and kidneys will also be enlarged and discoloured. Haemorrhages may be found on the heart and intestines. Lymph nodes will be enlarged.

Diagnosis

Diagnosis is confirmed by the presence of parasites in red blood cells in blood smears and by the symptoms. Concurrent infection by babesia or other protozoan parasites may confuse the diagnosis.

Treatment, Control and Prevention

Treatment with tetracyclines and oxytetracyclines or imidocarb gives good results if used early in the disease and at full dosage but relapses 20-30 days later are not uncommon.

Control can only be effected by control of ticks (which is difficult), control of movement and the keeping of cattle away from wildlife. If calves can be exposed to the disease through infective ticks then they can develop a premunity which will protect them in later life, although they will remain carriers of the parasite. (See Section 22-1). Convalescent animals should be well fed. (See Section 130).

Cattle of any age can be vaccinated using a live vaccine of A. centrale which causes the mild form of the disease. With the vaccine antibiotics are used to help control the symptoms.

A.H.A's should always remember that both anaplasmosis and piroplasmosis can be spread to healthy animals by infected blood on a syringe or on a needle used to take blood samples or when injecting animals. For this reason a fresh needle should, whenever possible,be used for each injection. During vaccination a supply of sterile needles should always be kept available.

Benign Bovine Theileriosis
(Section 62)

Nature and Occurrence

Generally a mild tick-borne disease of cattle. Recorded in most countries of the world and caused by Theileria mutans, a parasite which appears under the microscope very similar to T. parva the cause of East Coast Fever, transmitted by R. appendiculatus, R. evertsi and A. variegatum. African buffaloes (Syncerus caffer) and water buffalo (Bubalus bubalis) are also susceptible.

Symptoms

Symptoms are not marked but include a rise in temperature to about 39°C, swollen lymph nodes and anaemia. In certain countries of southern Africa the disease may be acute (Tzaneen disease). In enzootic areas, a disease of calves with nervous symptoms called "Turning sickness" is attributed to invasion of the brain by the parasites.

Diagnosis

Diagnosis is by detection of the parasites in blood smears.

Treatment, Control and Prevention

Drugs are effective but the disease is usually so mild that no treatment is called for.

Sweating Sickness and Tick Paralysis

(Section 63-1)

Nature and Occurrence

A disease condition arising from a toxicosis (poisoning) associated with infestation of ticks the saliva of which contains one or more toxins. The disease is confined almost entirely to young cattle especially those under 1 year of age and almost entirely to Africa south of the Equator, to India and Sri Lanka.

Symptoms

The severity of symptoms varies greatly. These may include the following: high temperature, off feed, haemorrhagic or inflamed mucous membranes, thirst, secretion from the eyes and nose, grinding of teeth, diarrhoea, and difficulty in walking. The characteristic feature is the development of areas of moist eczema which appear two or three days after the temperature rises, on the sides of the head, neck and body, which may sometimes become generalized. The name of the disease stems from this symptom.

A high proportion of calves die but survivors start feeding and quickly recover, although some hair may be lost from the eczematous areas.

The mortality and morbidity depend very largely on the strains and intensity of the ticks present.

At post-mortem examination the carcase will be found to be emaciated, with haemorrhages in the intestinal tract and lungs, fluid in a number of organs while the liver may be swollen and lymph nodes enlarged.

Diagnosis

Diagnosis is based on symptoms, post-mortem lesions and the species and intensity of ticks present.

Treatment, Control and Prevention

Treatment is rarely effective, although good nursing will help. Sulphonamides and antibiotics may be tried.

Control of ticks by short interval dipping or spraying is the only effective means of control in areas where the disease occurs.

Tick Paralysis
(Section 63-2)

Paralysis due to toxins injected by various species of ticks (notably Hyalomma species) affects cattle, camels, sheep and other species in localized areas of Africa, Asia, Europe and Australia.

Mediterranean Fever
(Section 64)

Nature and Occurrence

A non-contagious disease of cattle and water buffalo (Bubalus bubalis), in Mediterranean areas, certain African countries, Near East and Far East caused by Theileria annulata (similar to T. parva), and transmitted by ticks of the Hyalomma genus. Biting flies are not vectors.

Symptoms

There is a temperature rise and the animal goes off feed. This is followed by anaemia, constipation, discharges from nose and eyes and the swelling of body lymph nodes.

Mucous membranes later become yellow; and diarrhoea often blood tinged, develops. The animal may die in 8-15 days or recover or the condition may become chronic and the animal may recover only after a long period.

On post-mortem examination carcase is anaemic and yellow; the liver enlarged and brown or yellow in colour; the spleen enlarged and soft; the lymph nodes enlarged; kidneys pale; there is ulceration of abomasum with haemorrhages; the lungs congested; and haemorrhages on the heart.

Diagnosis

The disease can be confused with babesiosis or anaplasmosis but the parasite *T. annulata* can be shown in lymph nodes and liver smears.

Treatment, Control and Prevention

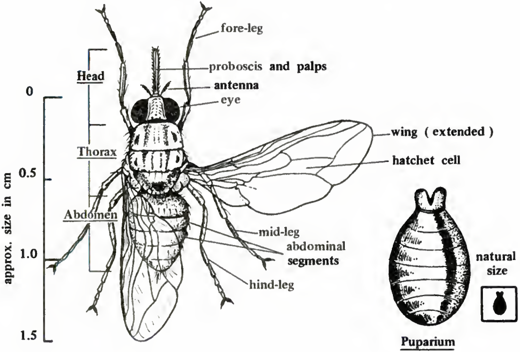
Infection may suddenly subside of its own accord, but treatment with halofuginone or paraquinone, if available, is effective.

In endemic areas calves have a mild form of the disease, recover and become premune. Exotic cattle are very susceptible.

Control is best achieved through control of ticks, immunization and control of cattle movements.

Immunization of calves was formerly carried out using infective blood from immune carrier animals but an effective tissue culture vaccine has recently become available.

Fig 29 - A TSETSE FLY AND PUPA (See section 65)



(2) Protozoan Diseases Transmitted by Flies

Tsetse and Other Flies
(Section 65)

As was explained in Chapter 3, Section 14, trypanosomes form a group of protozoan organisms which usually undergo part of their reproductive cycle in an intermediate host but in this case the intermediate host is a fly, generally a tsetse fly (Glossina spp.) Sometimes, however, other biting flies transmit the disease mechanically; that is it transfers fresh blood on its biting parts from an infected animal to a non-infected animal. An example of this latter means of infection of the disease is in camels. Similar means of infection occur in other species of animals in Asia and South America.

Most domestic animals, man, and many wild animals, may become infected with one or more of the trypanosome species. Infection with trypanosomes is referred to as trypanosomiasis. Strains (species) of trypanosome affecting man do not affect animals.

In Africa, while it is the Glossina species of flies (the tsetse flies) which mostly transmit the trypanosome, in some areas of Africa and in other regions, such as Latin America, transmission takes place mechanically as described above. One trypanosomal disease called dourine, a disease in horses, is transmitted in a third way, namely, by coitus (the act of sexual intercourse between males and females).

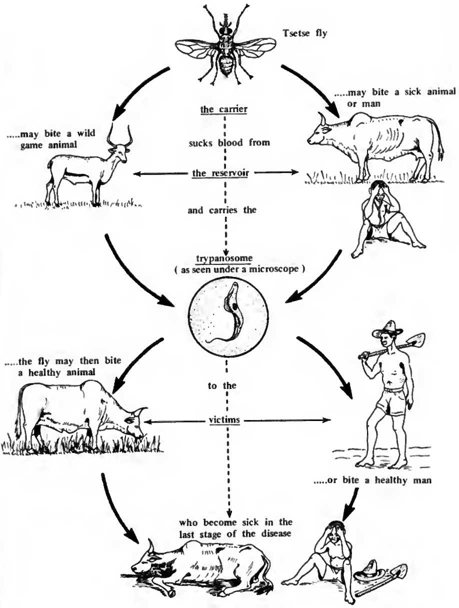


Fig 30 - THE LIFE CYCLE OF TRYPANOSOMA. (See section 66)

Tsetse fly
.....may bite a wild game animal
the carrier
sucks blood from
the reservoir
.....may bite a sick animal or man
and carries the
trypanosome
(as seen under a microscope)
.....the fly may then bite a healthy animal
to the
victims
.....or bite a healthy man
who become sick in the last stage of the disease

Tsetse flies may be divided into three groups:

(i) those the habitat of which is forest

(ii) those that inhabit riverine areas, and

(iii) the most important group for animals are those which inhabit savannah country which otherwise would be suitable for grazing animals.

When a tsetse fly bites an infected animal the trypanosomes in the blood of the infected animal enter the salivary gland of the fly and there multiply. A tsetse fly must have a feed of blood before it can breed.

Before the fly feeds on the blood of another animal it injects saliva into the animal to prevent the blood clotting and in so doing infects the animal with trypanosomes.

Cattle can be infected:

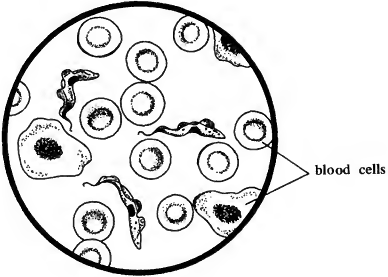
(i) if they live or move into a tsetse area and are bitten by an infected tsetse fly;

(ii) if they are in a herd in a non-tsetse area into which an infected tsetse may be carried and which before it dies because of unfavourable conditions, bites one or two animals. Infection from these animals is then spread amongst the herd by mechanical transmission.

(iii) from an infected animal straying into a herd in a non-tsetse area the disease being spread from it mechanically to other animals. Wild animals commonly act

Fig 31 - TYPICAL TRYPANOSOMES AS SEEN UNDER THE MICROSCOPE.

(See section 66)



as reservoirs of infection from which flies become infected later infecting cattle with the disease. Human beings also become infected and in them the disease is called 'sleeping sickness'.

In West Africa some breeds of indigenous cattle such as the Muturu and N'Dama have a higher degree of resistance or tolerance to trypanosomiasis than other breeds. The N'Dama breed is now being introduced into areas where formerly cattle could not be kept.

For A.H.A's interested in the tsetse aspects of trypanosomiasis there is a 3-volume Training Manual for Tsetse Control Personnel published by FAO which goes into the subject in great detail. It is available from the Animal Production and Health Division, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy.

Trypanosomiasis
(Section 66)

Nature and Occurrence

A disease caused by a microscopic protozoan organism called a trypanosoma which swims around in the blood of an animal infected through the bite of a fly (see Section 65). The most serious of the trypanosomes infecting cattle which the A.H.A. will frequently hear of are Trypanosoma congolense and T. vivax. The disease in camels also very common is called 'surra' and is caused by T. evansi (see Section 105) which also causes a serious disease of horses in Asia and Central and South America.

Symptoms

In cattle the disease generally takes a chronic form.

The first evidence of infection is a rise in temperature 5-7 days after having been infected by a fly.

Symptoms may then develop over weeks but lactating cattle develop symptoms more quickly. The animals go off their feed; are dull and lack energy. The coat becomes staring, they lose condition and milk yield is reduced and they cannot feed their calves. Animals show discomfort in strong light, the eyes appear sunken and there may be a slight discharge from them. Lymph nodes may be swollen and diarrhoea may appear.

In the final stages the animal becomes very weak and emaciated and swellings may appear along belly and dewlap, the animal may die 3-12 months after infection.

In pig and horse the symptoms are usually acute, the animals dying shortly after a period of high temperature.

On post-mortem examination the carcase may be emaciated and anaemic and the spleen and lymph nodes will be enlarged.

Diagnosis

Although the above clinical symptoms, knowledge of the history of the herd and the situation in which the animals are found could lead the trained A.H.A. to suspect that the animal is suffering from trypanosomiasis, the positive diagnosis of the disease can only be made through the demonstration of the parasite. Such diagnosis is made from blood smears (both thick and thin should be made).

In some cases wet smears of fresh blood (a drop of blood) on which a cover slip has been placed and examined under the low power of the microscope may reveal the mobile parasite more easily than an examination of a stained smear.

Lymph node smears may sometimes reveal the parasite when blood smears are negative.

Treatment, Control and Prevention

Several drugs are effective in treating infections with the various species of trypanosomes. These include Berenil, Antrycide,* Ethidium, Novidium and Samorin.

Drugs which are used prophylactically in areas of low tsetse density include Antrycide pro-salt,* Prothidium, Samorin, Trypamidium and Naganoe specifically for T. evansi in camels. These drugs form deposits in the animal body from which they are slowly absorbed and act against the trypanosome over a long period.

All these are names which the A.H.A. is likely to hear and are mostly the names of proprietary drugs. The Veterinarian will instruct the A.H.A. which drugs he should use. His instructions should be carefully followed since there is always a danger that the misuse of drugs or giving insufficient dosage may lead to "drug fastness" (resistance of the trypanosome to the drug).

* It is understood Antrycide is once more being manufactured in India but has not so far been the subject of tests (1983).

Control and prevention of trypanosomiasis depend on being able to reduce contact between livestock, wild animals and tsetse to the minimum. Eradication of tsetse, control of animal movements, good diagnosis and correct use of drugs for treatment or prophylaxis are important but eradication of wild life is no longer considered to be of value.

(3) Protozoal Diseases Spread Without an Intermediate Host

Coccidiosis

(Section 67)

Nature and Occurrence

Disease of the digestive tract (intestine and liver) of all animals caused by single-celled protozoal organisms. The organisms are shed in the faeces and infection is brought about by the eating of contaminated feed stuffs or forage.

There are many types of these parasites each one affecting only one particular species of animal and in most cases affecting a particular part of the intestinal tract of the animal concerned. The parasite specific to each animal will not affect other species of host.

Whereas the tick-borne diseases and the fly-borne diseases already dealt with generally undergo part of their reproductive cycle in an intermediate host (the tick or the fly) coccidia, in this third group, reproduce and spread without the intervention of an intermediate host.

Symptoms

Symptoms are usually only seen in young animals but adults may be carriers. Diarrhoea, bad smelling and blood stained faeces are characteristic of the disease.

Sick calves grind their teeth in pain and become thin and anaemic. They may die within about two weeks. If recovery takes place it is slow and the animal loses condition and may develop pneumonia.

Mortality varies from 20-40 percent but recovered animals have a high degree of immunity to further infection.

On post-mortem examination the intestinal tract shows haemorrhages and ulceration may also be present.

Diagnosis

A smear of fresh faeces or that taken from the infected part of the intestinal tract at post-mortem will reveal the characteristic egg shaped organism under the microscope.

Treatment, Control and Prevention

For treatment Amprolium, or sulphonamide drugs are effective and their use may be advised by the Veterinarian.

The separation of young animals from adults and good hygiene will help to prevent the disease.

(4) Protozoal Disease Spread by Mating

Trichomoniasis
(Section 68)

Nature and Occurrence

A genital disease of cattle caused by a protozoan, (Trichomonas foetus).

The disease occurs in many countries bieng particularly common in European stock. The disease is spread by mating.

Symptoms

The condition is characterized by a catarrhal inflammation of the vagina and uterus. Abortion may be caused or the foetus may die in the uterus with subsequent metritis.

Pus in the uterus with a discharge from the vulva is a common symptom in trichomoniasis.

Sometimes, in spite of infection, the cow carries its calf normally, in other cases the disease appears to clear itself up.

Diagnosis

Diagnosis can often be made by finding the protozoa in the discharge of cows returning to the bull.

Diagnosis can also be made in the laboratory from tests made on samples of vaginal mucus or sheath washings from the bull and from material from the stomach of a freshly aborted foetus.

Treatment, Control and Prevention

Most cows overcome the infection without treatment provided they are not again mated to an infected bull for at least 3 months. In the bull treatment is unsatisfactory.

Control consists of the use of A.I. with semen fromn non-infected bulls or the use of clean bulls (if A.I. cannot be used) on cows which have not been bred for 3-6 months and have calved down normally.

CHAPTER 8

DISEASES OF CATTLE AND BUFFALOES CAUSED BY PARASITES

(1) External Parasites

Introduction
(Section 69)

What parasites are and the place they occupy in the groups of living organisms which cause disease in animals were described early in Chapter 3. There it was stated that for the purpose of this Manual, parasites were either ecto-parasites, living on the outside of the host animal, or endo-parasites living inside the host animal.

External parasites have jointed legs and are referred to as arthropods. Many have four pairs of legs and these include ticks and mites.

Ticks are of great importance. They are found in most tropical and sub-tropical countries and transmit many serious diseases (the "tick-borne diseases") as well as themselves causing serious adverse effects on the animals they infest.

Ticks and their effects on animals were described in Chapter 7, Sections 53 and 54. It is important that the A.H.A. has a good understanding of the diseases transmitted by ticks and for this he must first know what ticks are, how they reproduce and transmit the various diseases and the effects they have on the animal they infest.

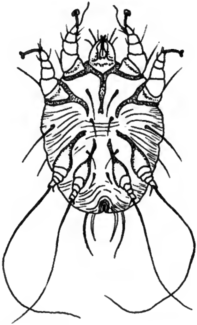


Fig 32 - THE MANGE MITE. (See section 70)

Mites also have four pairs of legs but are far smaller (pin-head or smaller) than ticks. They are important because they cause various types of mange in the different species of animals.

Flies are also important external parasites - apart from their role as transmitters of disease (e.g. tsetse flies) they may adversely affect the host animal by sucking blood, irritating it and preventing feeding or by laying eggs on its body which develop into larvae which then invade and damage the host's tissues.

Mange

(Section 70)

Nature and Occurrence

An inflammation of the skin caused by small parasitic mites which burrow into the skin.

There are several different kinds of mange each named after the mite which causes the disease, i.e. sarcoptic mange (or scabies), psoroptic mange and demodectic (or follicular) mange.

Cattle and buffaloes may contract both sarcoptic and demodectic mange. In camels sarcoptic mange is very common.

In sheep the disease caused by a psoroptic mite is called sheep scab and is very important since it adversely affects the wool of sheep and causes serious losses to the wool industry. Mange is also very important in goats, which contract both sarcoptic and demodectic mange, because of the severe damage done to the skin, one of the most valuable export items of many tropical countries.

In pigs both sarcoptic and demodectic mange are found.

Symptoms

Symptoms usually start on the neck and face spreading to other parts of the body. There is loss of hair and scab formation. The skin becomes coarse and thick and forming hard folds; the hair falls out and the animal suffers severe irritation.

Animals not properly fed and in poor condition suffer more severely than animals in good condition. If the animal improves in condition the disease may disappear but it will reappear if the animal's condition again deteriorates.

Diagnosis

Diagnosis can be confirmed from a scraping made deep into the skin and examined under the microscope.

Treatment, Control and Prevention

Mange (with the exception of demodectic mange which is very difficult to treat successfully) can usually be controlled by dipping with acaracides.

A number of products can be used as skin washes but before their use the hair on and around the affected area should be clipped as close as possible (the clippers should be sterilized before using on another animal) and scrubbed with soap and water. Effective dressings include gammexane (lindane), limesulphur (2 percent calcium polysulphide), coumaphos (0.3 percent) and toxaphene (0.5 percent) which may be available in dip fomulations.

Most require repeated applications at weekly intervals until healing is seen to be taking place.

Invermectin injections (repeated if necessary) will cure all types of mange including demodectic, if supplies of this can be obtained.

Other External Parasites
(Section 71)

Other external parasites, such as lice and fleas may be found on the skin of animals.

Lice may be found on poorly fed cattle kept housed and are found particularly in the ears and near the base of the tail. If left untreated animals may become anaemic and emaciated.

Dipping, spraying or dusting with acaracides and or insecticides are effective.

Warble flies, in some higher and colder parts of the tropics, lay their eggs on the backs of cattle, the larva or maggot developing under the animal's skin.

The maggot causes great damage to the hide and may in fact ruin it. Furthermore, the larvae damage the flesh of meat animals and "fly worry" by the fly causes loss of weight and reduced milk yield.

Treatment, Control and Prevention

Consists in the use of insecticides on the backs of the animals, by the systematic use of organophosphorus compounds or the use of Invermectin.

Camel and sheep nostril flies both have similar characteristics. The larvae, laid in the nasal tract, find their way into the sinus of the animal and develop into maggots. Affected animals shake their heads, sneeze and are restless, sheep particularly suffering a severe loss of condition.

"Screw-worm" infection in Central and Latin America is caused by the larvae of a fly (Cachtimya hominivorax) which lays its eggs on the edges of wounds in cattle and other animals. The eggs rapidly hatch to form maggots which burrow into the flesh turning small wounds into severe abscesses, which if not treated, often progress and kill the animal.

All wounds seen at the daily inspection of the herd and the navel of all newborn calves must be treated at once with one of the proprietary screw-worm pastes available.

Procedures such as castration, dehorning, docking, branding and even parturition should not be undertaken during the fly season, but in some areas the flies are active throughout the year and vigilance is required at all times to detect and treat wounds early.

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(2) Internal Parasites

Introduction
(Section 72)

Internal parasites are referred to as helminths and these are divided into two groups, the flat worms (Platyhelminthes) and the round worms (Nemathelminthes).

The flat worms are divided into flukes (Trematodes) and tape worms (Cestodes).

The round worms are divided into a number of groups but there is only one important group - the Nematodes.

Effects of Internal Parasites

Parasites harm their hosts in different ways:

(i) by absorbing food from the intestinal tract intended for the host causing emaciation and poor condition (e.g. worms such as the tape worm);

(ii) by sucking blood from the wall of the intestinal tract (e.g. wire worms, hook worms);

(iii) by feeding on tissues of the host (e.g. certain worms such as chabertia);

(iv) by causing obstruction in the intestinal tract (e.g. large numbers of the bigger worms);

(v) by irritating the intestinal tract and causing diarrhoea (e.g. wire worms).

All organs of the body may be attacked by parasites including the lungs, liver, body cavities, blood vessels, heart, brain and eyes but the largest number are found in the intestinal tract.

The importance of parasites (both internal and external) cannot be over emphasized. They do not have so obvious or marked an effect as diseases caused by bacteria, viruses or protozoa. They may cause death by themselves but their major effect is the great economic loss they cause resulting from the slow rate of development of infected young animals, the weakening of animals and the lowering of their resistance to disease and the reduced production of milk, meat and eggs which their presence causes.

Symptoms

Symptoms arising from internal parasitism may include any of the following: variable appetite; digestive disturbances; loss of condition; stary coat; anaemia; pale mucous membranes, constipation or diarrhoea; coughing and symptoms of bronchitis and swellings under the jaw (bottle jaw) and along the belly.

Life Cycle

In order to develop and complete their life cycle parasites generally spend part of the life cycle away from the host either on the ground or in grass and sometimes in another animal (an intermediate host) such as a snail, an earth worm or an insect.

The extermination of the intermediate host may be the easiest way to control the parasite. A good example of this is the control and eradication of ticks in the control of the tick-bone diseases (see Section 56). Another is the eradication of snails to control liver fluke (see Section 73).

Knowledge of the life cycle is very important since on this control of the parasite and its prevention can be based.

In order to simplify the description of the internal parasites, of which there are many thousands, the description of these parasites will be dealt with in this Manual in three groups:

-	Flukes (Trematodes)	(Section 73)
-	Tape Worms (Cestodes)	(Section 74)
-	Round Worms (Nematodes)	(Section 75)

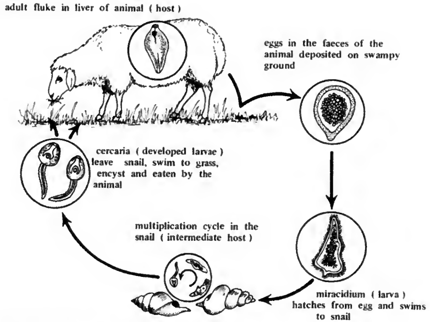
Flukes
(Section 73)

The Liver Flukes (Fasciola gigantica and F. hepatica) - the cause of fascioliasis.

F. gigantica is the common liver fluke of Africa but the species occurs in almost all tropical countries.

F. gigantica occurs mainly in cattle but also in sheep, camels, and other ruminants, while F. hepatica is found mainly in sheep but also in cattle, camels and other ruminants. Because of their wallowing characteristics buffaloes are greatly predisposed to fascioliasis.

Fig 33 - THE LIFE CYCLE OF LIVER FLUKE. (See section 73)
(Fasciola Spp.)


adult fluke in liver of animal (host)
eggs in the faeces of the animal deposited on swampy ground
miracidium (larva) hatches from egg and swims to snail
multiplication cycle in the snail (intermediate host)
cercaria (developed larvae) leave snail, swim to grass, encyst and eaten by the animal

Note - miracidium the youngest stage in the life history of a trematode.
cercaria developed larval stage of the liver fluke having a tail.

The flukes are flat, unsegmented, leaf shaped parasites, the adults being about 19-50 mm long and 12 mm wide. They are greyish-brown in colour.

The adult fluke in the liver ducts lays eggs which pass down with the bile to the intestine and so to the ground with the faeces. The eggs develop through various stages into minute worms, penetrate certain species of snails - these being called the intermediate host. (See Fig. 33.)

Infection takes place in damp, marshy or swampy areas where snails are found. After passing through a number of stages of development in the snail the worm escapes and swims around finally attaching itself to a plant leaf which is eaten by its host animal.

In cattle the worm burrows through the wall of the intestine into the abdominal cavity from where it migrates through the liver to the bile ducts where it develops into an adult, which in turn lays eggs.

The parasite may cause great damage to the bile ducts and to the liver producing a condition known as "liver rot".

Symptoms

Symptoms vary greatly according to degree and length of period of infection.

Diagnosis

Diagnosis is made by examination of faecal specimens for eggs.

Treatment, Control and Prevention

There are a number of effective drugs used for treatment but most are too expensive for use except on valuable animals. Carbon tetrachloride and hexachlorethylene are less expensive but somewhat toxic so that if used they need to be given under careful supervision.

Because the intermediate host, the snail, is found in marshy, wet places and near rivers, animals should be kept away from such places as far as possible and given water from troughs on higher dry land.

Copper sulphate can be used on such areas and will kill the snails but it is expensive and in any case will have only a temporary effect and may kill any fish present.

Other Flukes

Other flukes are the conical fluke found in the rumen of cattle, sheep and goats; which, while generally harmless, can sometimes cause emaciation and the bilharzia fluke occurring in cattle, sheep and goats which feeds on blood and inhabits the blood vessels close to the intestine, the resulting disease condition being known as schistosomiasis. This is a most serious condition causing debility and often death in the localized areas of the world where it occurs.

Tape Worms (Cestodes) and "Measles"
(Section 74)

Tape worms are long, segmented, flat, white worms. They have a small head with suckers and sometimes hooks but no mouth (they have no digestive tract). The rest of the body consists of segments each having male and female organs and in which a large number of eggs develop. (See Fig. 34.)

As the segments become ripe they leave the worm and pass out with the faeces.

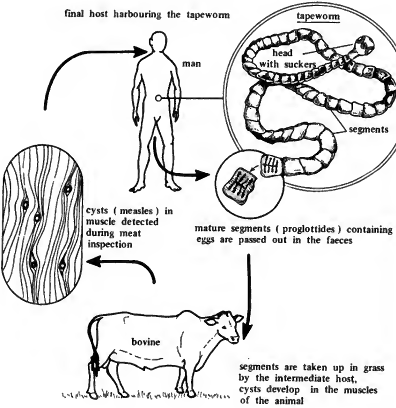
Most animals including man can be infected with tape worm and many tape worms occur in domestic and wild ruminants in tropical countries.
The tape worms are usually found in the small intestine of the host.

The tape worm requires an intermediate host to complete its life cycle. Its eggs will not hatch until they have been swallowed by an intermediate host. In the intermediate host it penetrates the intestinal wall and migrates to a suitable part of the body,such as muscle, where it develops into a cyst containing a cavity filled with fluid with one or more heads on its wall. This is called the "bladder worm".

When the final host (such as man) eats that part of the intermediate host in which the bladder worm is situated, the head of the bladder worm attaches itself to the intestinal wall, and develops into a tape worm.

Fig 34 - LIFE CYCLE OF THE MOST COMMON HUMAN TAPEWORM
(Taenia saginata)

(See section 74)


final host harbouring the tapeworm
man
tapeworm
head with suckers
segments
cysts (measles) in muscle detected during meat inspection
mature segments (proglottides) containing eggs are passed out in the faeces
bovine
segments are taken up in grass by the intermediate host, cysts develop in the muscles of the animal

The intermediate host of tape worms is an animal which normally or accidentally can be swallowed by the final host. Cattle and pigs act as intermediate hosts for human tape worms (Taenia saginata and Taenia solium). Humans become infected by eating uncooked meat containing small tape worm cysts.

A large tape worm (Moniezia expansa), up to 600 cm in length and 1.6 cm wide, occurs world wide in sheep, goats and cattle in which it is found in the small intestine. Its intermediate host is a very small pin-head size mite which is eaten with the grass.

A tape worm of dogs and jackals (multiceps multiceps) is important because sheep and cattle are the intermediate hosts and pick up the segments on the grass, the bladder worm developing into cysts in their brains and causing them to develop an unsteady gait and walk in circles.

The echinococcus tape worm, also a tape worm of dogs, jackals and wild dogs, is somewhat similar but more dangerous because all domestic animals and man may be the intermediate host. Hydatid cysts which are a stage in the life cycle of this parasite may occur in various parts of the body and cause a serious disease condition in man.

Treatment, Control and Prevention

No treatment exists for the cystic stages of tape worms but they must be carefully looked for in meat inspection and in affected meat which has been condemned. The careful disposal of human faeces would do much to eliminate the condition.

Tape worms in humans can be successfully treated by a variety of drugs. Treatment of tape worms in cattle is rarely justified. Dogs are often treated, sometimes in mass campaigns to control echinococcus.

The Veterinarian will advise on any treatment or control measures which may be necessary.

Round Worms
(Section 75)

There are numerous round worms occurring in domestic animals and almost all are harmful to their hosts.

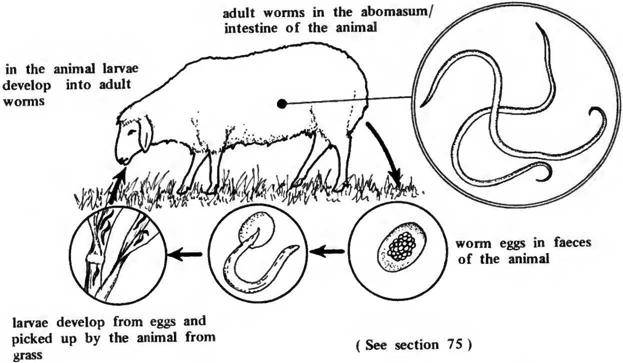
They are referred to as "round worms" because they are long and round in shape. Some are as big as a pencil while others are small, similar to a piece of thread, and sometimes even difficult to see.

Round worms lay large numbers of eggs which are passed out in the faeces. Examining faeces under the microscope for the eggs will indicate the kind of worms present and the extent of the infection.

From a practical point of view round worms can be divided into two groups:

(1) Small round worms

(2) Large round worms


adult worms in the abomasum/ intestine of the animal
in the animal larvae develop into adult worms
worm eggs in faeces of the animal
larvae develop from eggs and picked up by the animal from grass

(See section 75)

Fig 35 - LIFE CYCLE OF A STOMACH/INTESTINAL WORM IN SHEEP

(1) Small round worms

These are the most important of the internal parasites and the most frequently encountered. The life cycle is similar in all of them and is "direct" in that no intermediate host is involved.

The adult worms live in the stomach and intestines. The females produce large numbers of eggs which pass out with the faeces. In warm favourable climatic conditions the eggs hatch. The larvae pass through a number of changes before they are able to crawl onto the grass near the faeces in which they left the animal.

Animals grazing, or calves and lambs suckling from udders that have become contaminated by manure, become infected. In the animal the parasite passes through more changes and is then able to lay eggs.

These worms are grouped according to where they live in the intestinal tract in either (a) the stomach, (b) the small intestines, or (c) the large intestines.

(a) Stomach Worms

- The wire worm (Haemonchus spp.)

  Are red in colour 10-20 mm (males) and red striped 18-30 mm (females), and are easily seen at post-mortem. Occurs in sheep, goats, cattle, camels and other ruminants all over the world. The worms suck blood so that the animals become anaemic and swellings appear under the jaw ("bottle jaw").

- Brown stomach worm (Ostertagia spp.)

  Smaller than wire worm and sucks blood and also often cause diarrhoea.

- Stomach Bankrupt worm (Trichostrongylus axei)

  Smallest of stomach worms but similar to above in life cycle etc. Occurs in cattle, sheep, goats, camels and rabbits.

(b) Small Intestine

- Bankrupt worm (Cooperia spp.)

  Very small worms hardly visible to naked eye - cause diarrhoea - loss of condition - off feed. Occurs in sheep and young ruminants.

- Hook worms (Ancylostoma spp., Bunostomum spp.)

  Fairly easily seen - red colour - the head end is hooked. The larvae can enter animal through skin. A vigorous blood sucker causing anaemia, loss of condition and swelling under jaw. Ancylostomum occurs in man and carnivores. Bunostomum occurs in cattle, sheep and goats.

- Long necked worm (Nematodirus spp.)

  Similar in size to hook worm but having a curled-up neck.

(c) Large Intestine

- Large mouth worm (Chabertia spp.)

  25 mm long, easily seen, has large mouth, sucks intestinal wall digesting it causing severe irritation and diarrhoea, sometimes blood stained. In colon of sheep, goats, cattle, other ruminants.

- Nodular worm (Oesophagostomum spp.)

  Same size (15-22 mm) as large mouth worms and are white. Larvae penetrate intestinal wall sometimes causing small abscesses causing a condition called "pimply gut"; may also cause diarrhoea. Occurs in sheep, goats and other ruminants in most tropical countries.

- Whip worm (Trichuris spp.)

  Found in caecum - have long tail like stock whip - easily seen - not harmful.

(2) Large round worms

These are called Ascaris worms and are much larger than the small round worms described above.

They occur in cattle, buffaloes, pigs, poultry, dogs and man but not sheep.

They may be up to 450 mm in length and thick as a pencil.

The worm found in cattle and buffaloes is called Ascaris vitulorum. It is especially common in young animals when kept in small areas and in dirty pens. Eggs are produced in the faeces. An animal ingests the eggs with feed and water, or in young animals from udders of cow. Eggs are swallowed and hatch in intestine, burrow through the wall and reach liver or, get into blood circulation and reach liver that way. They are carried by the circulation to the lungs migrating via the windpipe to the pharynx and are swallowed by the animal. In the intestines they become adults.

The parasite causes loss of appetite, poor condition and sometimes diarrhoea. Affected animals become weak and lose resistance to other diseases.

In pigs the ascaris worm is called Ascaris suis. The life cycle is similar to the above. Young pigs are very susceptible and develop diarrhoea, pneumonia and become stunted in growth.

Treatment, Control and Prevention

There are many effective drugs for treatment of worms in all species of animals but they are expensive and need to be given on the advice of the Veterinarian. These remedies include medicines such as Phenothiazine, Thibenzole, Tetramisole, and Piperazine.

The Veterinarian will advise on the best remedy available for a particular treatment, the dosage to be used and the way of administering it to the animals concerned.

The best means of control is to subject the whole herd to routine treatment at intervals throughout the year, the dates being decided on by the Veterinarian who will be keeping in mind the species and life cycle of the species and the climate of the area. At the same time mineral licks with iron (and possibly with an anti-worm remedy), should be given.

Overstocking of pastures should be avoided; pastures should be rotated; wet or moist areas should be avoided; watering should take place from troughs surrounded by gravel areas or, if from dams, water should be piped to a trough. In stables all feed should be fed in troughs and not off the floor.

After treatment animals should not be returned to heavily infected pastures. These should be left long enough for the worm populations to die off (in practice this should be as long as possible) or they should be ploughed up and cropped.

Young animals should not be grazed with adult animals. It should be remembered that well fed animals in good condition are less liable to infection than animals in poor condition.

CHAPTER 9

DISEASES OF CATTLE AND BUFFALOES CAUSED BY FUNGI AND NON-INFECTIOUS CONDITIONS

(1) Fungal Condition

Ringworm

(Section 76)

Nature and Occurrence

Ringworm is a disease of the hair and skin found world wide on most domestic animals. It is caused by various fungi and is common in cattle and especially calves which are very susceptible to the disease. Man also can become infected and the A.H.A. should always wear rubber gloves when handling animals or material which might be infective.

Symptoms

Round areas of inflammation appear, generally on the head and neck. In young animals the areas will appear near the mouth, infection having come from the dam. Some irritation may arise.

The areas become covered with grey, scaly crusts. If the infection is not treated the disease will spread.

The infection is easily spread from animal to animal by brushes, ropes, scratching posts, water troughs, etc. Damp conditions, poor feeding and housing of animals predispose to the condition.

Diagnosis

Diagnosis can be confirmed by the finding of the fungus on infected hairs by microscopic examination. Before examination the specimen is treated with potassium hydroxide (see Appendix 10) which clears the specimen and shows up the fungus clearly.

Treatment, Control and Prevention

The thick crusts are first removed with a brush and soap and water.

Daily applications of a mixture of tincture of iodine and glycerine in equal parts is often effective. Griseofulvin, an antibiotic, is effective but too expensive, except for very valuable animals.

The application of tincture of iodine of Lugol's solution of iodine every other day may also be effective.

Prevention lies in examining animals frequently and separating and treating those infected. Crowded conditions should be avoided and the animals fed adequate and good feed and if possible with supplementary vitamins A and D.

(2) Non-Infectious Conditions

Bloat (Hoven)

(Section 77)

In simple terms bloat is one of a number of kinds of severe indigestion which occur in ruminants. Gas normally forms in the rumen from the fermentation of feed and is belched out through the opening into the gullet (oesophagus) and out through the mouth.

Bloating occurs in cattle, sheep and goats when too much gas accumulates in the rumen (first stomach) and the animal cannot get rid of it without help. This may be caused by very rapid gas formation, paralysis or obstruction of the oesophagus.

When the gas builds up quickly in the rumen, it presses on the diaphragm. It is then known as acute bloat which if not quickly relieved may lead to the death of the animal from asphyxiation. If it occurs less severely and occurs frequently in the same animal it is referred to as chronic bloat.

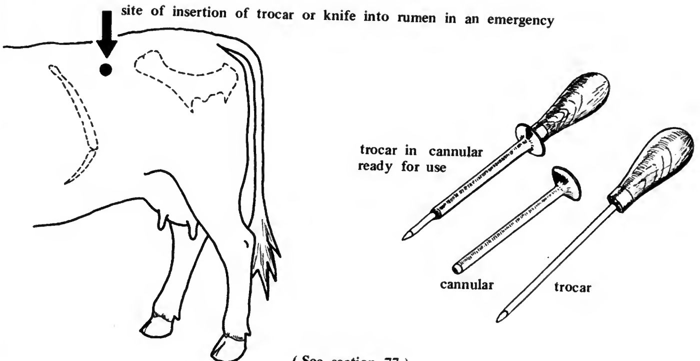
Bloat may be caused by indigestion and also by cattle grazing lush green pastures of legumes such as clover or alfalfa which ferment in the rumen producing large amounts of gas.

Symptoms of bloat include: the animal in pain and distress; cessation of grazing; the animal standing feet wide apart, mouth open and drooling; left side of animal distended; animal breaths rapidly and the mucous membranes of its eyes and mouth are blue; if it walks does so with unsteady gait.

If the bloat is not too severe animals should:

(i) be kept on their feet;

(ii) a thick rope or smooth stick can be tied in the mouth - this encourages chewing and belching;


site of insertion of trocar or knife into rumen in an emergency
trocar in cannular
ready for use
cannular
trocar

(See section 77)

Fig 36 - USE OF TROCAR AND CANNULAR IN CASES OF BLOAT

(iii) if not too distressed animal can be walked slowly up hill to help gas escape;

(iv) the Veterinarian may advise drenching with warm milk and kerosene, repeated every half hour;

(v) the Veterinarian may pass a stomach tube down the throat into the stomach.

In the last resort it may be necessary to let out the gas by puncturing the rumen with a knife (even scissors) or a trocar and cannula (a hollow metal tube with a sharpened piece of metal running through it). This is done as follows:

(i) The knife or trocar is inserted through the skin on the left side at a point half way between the last rib and the point of the hip and the same distance below the lumbar vertebrae.

(ii) The instrument is directed with force downward and forward towards the right elbow. The trocar (the sharpened part) is then withdrawn and the cannula left in place.

(iii) If a knife or scissors are used, a hollow tube or piece of bamboo may be inserted in the opening to allow air to escape.

(iv) If the air in the rumen is not in a large pocket above the feed but instead is mixed with the feed the air which comes out will be "frothy" (called "frothy bloat"). A special medicine can be put into the rumen through the cannula to treat this or even a household detergent washing powder can be used, 10 grams of this being dissolved in water and poured in; this treatment being repeated later if necessary.

(v) To prevent further gas formation and, if available, 2 litres of hot water containing 100 ml of formalin should be introduced through the cannula. This too can be repeated if necessary.

To prevent bloat, cattle should not be put onto green pasture until moisture has dried off the herbage or, a full feed of dry grass or feed given before putting cattle onto green pasture.

Udder Conditions in Cattle
(Section 78)

Sore Teats

A common condition in milking cattle is sore teats with cracking of the skin usually caused by "wet milking". It may also result from cow pox and foot-and-mouth disease.

The condition starts as small round swellings in the skin of the teats or of the udder which become blisters and then turn into small abscesses containing pus.

A soothing antiseptic ointment may help to heal the sore.

Teat wounds

Wounds of teats are often caused by cuts and injuries from barbed wire and thorn bushes.

Wounds of this kind can lead to mastitis or inflammation of the udder.

Mastitis

Generally caused by the introduction of bacteria into the udder, through the teat orifice and teat canal, although bacteria sometimes gain entry through cuts, bruises, tears, etc.

The usual predisposing cause of mastitis is bad milking practice such as wet milking, lack of cleanliness, rough milking and incomplete stripping of teats.

Mastitis is often contagious and may spread throughout a herd if precautions are not taken.

Symptoms of mastitis include a swollen, tense, hot and painful udder, with a diminished milk yield. In some cases cows go off their feed.

Mastitis may be chronic or acute, the former being more common.

Chronic mastitis may show few signs of the condition. In such cases, however, the milk may be watery or bloody in appearance, has a bitter taste and lumps or clots may be seen in the first few drops of milk taken from an infected quarter.

On examining the udder the affected quarters may feel hard or "knob-like". The udder may be swollen and painful and the cow may go lame.

Eventually infected quarters may cease giving milk.

In acute cases the infected quarter will be swollen, tense, and painful; the milk yield decreases rapidly and the cow may have a temperature, go off its feed, lose condition and even die.

Mastitis is generally found if a "strip cup" is in regular use and the first few drops of milk on milking are squirted on to it. This will show up the clots and lumps mentioned above.

Treatment, Control and Prevention

Treatment is likely to be successful if started early. The udder can be bathed with hot water and stripped out. Antibiotics supplied in tubes for injection into the udder are squeezed into the teat canal after this has been cleaned with alcohol.

To enable the correct drug to be selected, a sample of milk for testing should be sent to the laboratory but in practice this may not be possible.

To prevent mastitis or its spread in a herd the following precautions should be taken:

(i) the hands of the milker should always be kept clean and washed between milking cows.

(ii) Infected cows should always be milked last - milk from infected quarters being fed to pigs and chickens.

(iii) The strip cup should always be used.

(iv) Any wounds on udders should at once be treated.

(v) Milking equipment should always be kept clean and disinfected between milkings.

(vi) If a cow's udder is seriously and chronically affected the cow should be sold to the butcher.

(vii) In herds where mastitis is a persistent problem the teats of all cows should be dipped in a cup containing a chlorine-type disinfectant immediately after they have been milked.

Other Non-Infectious Conditions
(Section 79)

There are numerous conditions, not so far specifically mentioned in this Manual, which the A.H.A. should always keep in mind.

When faced with a disease condition in animals he should first consider whether it could be due to an infectious or contagious disease since these may affect large numbers of animals and result in heavy losses.

However, other conditions not so obvious may cause ill-health and loss in animals. Such conditions can only briefly be mentioned here but the A.H.A. should always remember that they may appear similar to more serious infectious conditions. They include the following:

Foreign Bodies in Digestive Tract

Because they are ruminants cattle normally take into their mouths bunches of forage and swallow these with little chewing.

In this process pieces of wire or metal and stones can easily be swallowed and enter the reticulum or rumen. If sharp the wire or metallic object may penetrate the walls of these organs and enter the heart sac, causing a condition called "traumatic pericarditis".

The animal very quickly goes off its feed and its milk yield will be greatly reduced; surgical treatment may be necessary.

Heat Stress

It must always be remembered in tropical and sub-tropical regions that exotic breeds imported from temperate countries are not adapted to the high temperatures of tropical regions. They may show distress and go off their feed and be thought to be diseased when in fact they are only at the beginning of the process of becoming adapted to the local tropical conditions.

High Altitude

Animals born and reared in areas of high altitude are well adapted to such conditions. Animals introduced into such areas from sea level may show signs of distress such as rapid breathing and oedema of the lower neck and brisket, which may mislead the observer, although in fact such signs are only those of lack of adaptation.

Lightning

Many animals may be found dead close together showing few signs of disease. If there have recently been thunderstorms in the vicinity, death may have been due to lightning stroke. Usually the skin and hair show signs of burning.

Low Reproduction and Production Performance

When animals fail to breed or to produce satisfactorily this may not be due to a disease condition. It may simply be the result of malnutrition due to poor and inadequate grazing and lack of supplementary feeding, various mineral or vitamin deficiencies, poor management, or lack of adaptation to heat and humidity.

Malnutrition

Malnutrition is probably the cause of higher mortality and lower rates of reproduction and production than any other single factor.

Mineral Deficiencies

These generally arise as a result of animals being kept in areas where the soils are deficient in minerals or because of inadequate grazing combined with over-stocking, poor quality of herbage and lack of supplementary feed.

Generally, mineral deficiencies result in poor growth, low production and reduced fertility but certain specific diseases are associated with the shortage of certain minerals. A lack of calcium and/or phosphorus for example, will lead to rickets, and a lack of iodine to goitre and aborted calves.

Deficiencies are often difficult to diagnose and suspicious cases should be confirmed by laboratory tests.

They are usually corrected by supplying the deficient minerals in the form of a palatable "lick".

Plant and Mineral Poisoning

Plant poisoning is especially common in tropical areas. Such areas have large numbers of plants poinsonous to stock. Lack of good grazing may predispose animals to eating poisonous plants. However, plant poisoning is often blamed for sickness of animals when in fact the cause is a disease organism. In the case of mineral poisoning cattle in areas where arsenic is still used for dipping may suffer from cases of poisoning. The antidote to arsenic poisoning is 60-120g of sodium thiosulphate (photographeis "hypo") dissolved in a litre of water and given as a drench.

Snake Bites

In tropical regions, and especially in Africa, there are a variety of snakes poisonous to livestock. Bites usually result from the grazing animal disturbing or stepping on a snake. Immediate treatment with snake anti-venom is necessary but this is usually impossible in the case of animals bitten while in grazing areas.

"Snake bite" is often diagnosed when no other cause of sudden death appears evident. Before attributing deaths to snake bite it is essential to demonstrate the puncture marks made by the fangs of the snake which will usually be found on the face or legs of the animal.

Possible Diseases as Indicated by Symptoms

(Section 80)

When finding or being presented with sick animals and needing to report to his Veterinarian, the A.H.A., unless highly experienced, may have difficulty in identifying and naming the more important diseases which might be present.

The chart which follows, and similar charts in the case of sheep and goats and of pigs (but not of camels since the number of diseases involved in this species are likely to be few) attempt, therefore, to indicate the major diseases, from which the species of animal concerned may be suffering, as indicated by the main symptoms observed by the A.H.A.

Possible Diseases of Cattle and Buffaloes - Indication from Symptoms

Bacterial	Section	Found dead Sudden death	Lying down - Usually High Temp. - Dies	Lesions of mouth, lips, nasal discharge	Urine red	Diarrhoea scouring	Pale mucous membranes	High temperature	Coughing	Eyes running - Discharge from	Emaciation	Abdominal pain	Off feed	Lameness	Lumps & swellings	Nervous symptoms	Abortions	Infertility-sterility	Reduced milk production	Skin conditions
Anthrax	27	X						X									X		X	
Blackquarter	28-1	X						X						X					X	
Blue Tongue	82			X										X					X	
Botulism	29		X																	
Calf Diseases	30																			
Diphtheria	30-1			X				X	X											
Paratyphoid	30-3					X		X					X							
White Scours	30-2		X			X														
Cont. Abortion	31																X	X		
CBPP	32		X	X				X	X				X				X			
Cow Pox	51																		X	X
Foot Rot	33		X			X		X					X	X						
Haemorrhagic Septicaemia	34	X		X		X		X	X						X				X	
Infectious Conjunctivitis	35									X										
Johnes Disease	36					X					X						X			
Leptospirosis	37				X			X								X	X	X	X	
Malignant Oedema	28-2	X																		
Metritis	38							X											X	
Dermatophilosis	39										X			X						X
Tetanus	40												X			X				
Tuberculosis	41					X			X		X	X							X	
Vibriosis	42																X	X		
Wooden tongue and Lumpy Jaw	43										X				X					

	Section																			
Viral																				
Foot-and-Mouth	44			X				X					X	X					X	
Lumpy Skin	45			X						X					X					X
Malignant Catarrh	46		X	X		X		X	X	X					X	X				X
Mucosal Disease	47			X		X		X		X			X							
Rabies	48		X													X				
Rift Valley Fever	92		X																	
Rinderpest	49		X	X		X		X		X			X						X	
Three Day Sickness	50		X	X				X						X					X	
Protozoan/Rickettsia																				
(1) Tick-Borne																				
Tick Infestation	54		X								X									X
Anaplasmosis	61		X				X	X					X							X
Babesiosis	60		X		X		X	X					X			X	X			
Benign Theileriosis	62						X	X							X					
Corridor Disease	58		X																	
East Coast Fever	57		X					X	X						X					
Heartwater	59	X	X			X								X		X				
Mediterranean Fever	64			X			X	X					X		X					X
Sweating Sickness	63					X		X				X	X	X						X
(2) Fly-Borne																				
Trypanosomiasis	66					X	X	X		X	X		X		X					
(3) No Intermediate Host																				
Coccidiosis	67					X	X													
(4) By Breeding (Coitus)																				
Trichomoniosis	68																X	X		X
Parasites																				
(1) External																				
Mange	70																			X
Other	71																			X
(2) Internal																				
Flukes	73																			
Tape worms	74																			
Round worms	75					X	X		X		X		X							

Possible Diseases of Cattle and Buffaloes - Indication from Symptoms (cont'd.)

	Section	Found dead - Sudden death	Lying down - Usually High temp. - Dies	Lesions of mouth, lips and nasal discharge	Urine red	Diarrhoea scouring	Pale mucous membranes	High temperature	Coughing	Eyes running - Discharge from	Emaciation	Abdominal pain	Off feed	Lameness	Lumps and swellings	Nervous symptoms	Abortions	Infertility-sterility	Reduced milk product.	Skin conditions
Fungal																				
Ring worm	76																			X
Non-Infectious																				
Bloat	77	X	X				X					X	X		X				X	
Udder Conditions	78													X					X	
Foreign Body	79											X	X						X	
Heat Stress	79							X					X							
High Altitude	79																			
Lightening Stroke	79	X																		
Low Reproduction/Production	79																			
Malnutrition	79										X							X	X	
Mineral Deficiencies	79																	X	X	
Plant and Mineral Poisoning	79	X					X													X
Snake Bite	79	X																		

PART 4

DISEASES OF SHEEP, GOATS, PIGS AND CAMELS

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Fig 37 - POINTS OF THE SHEEP.

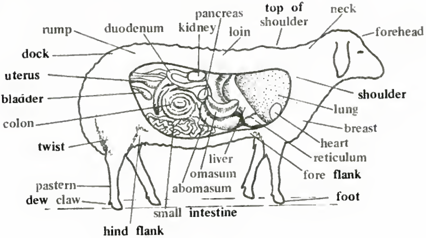
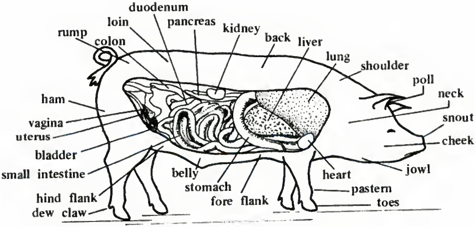


Fig 38 - POINTS OF THE PIG.



CHAPTER 10

DISEASES OF SHEEP AND GOATS

Introduction
(Section 81)

While sheep and goats are susceptible to many of the diseases which are described under 'Diseases of Cattle and Buffaloes' there are a number of diseases which are specific either to sheep or to goats or to both or to which sheep and goats are more susceptible than are the other species considered in this Manual. These diseases are:

Blue Tongue
Brucellosis of sheep and goats
Contagious caprine pleuro-pneumonia
Entero-toxaemia
Goat pox
Nairobi sheep disease
Peste des Petits Ruminants (PPR) - Kata
Rift Valley fever
Sheep pox.

Descriptions of these diseases follow after which a list will be found of those diseases described under 'Diseases of Cattle and Buffaloes' to which sheep and goats are also susceptible and which includes the Section numbers of the diseases for easy reference.

Blue Tongue (Catarrhal Fever of Sheep)
(Section 82)

Nature and Occurrence

An infectious disease of sheep and, in a very mild form, of cattle, goats and wild antelope, caused by a virus (of which there are numerous strains) which is spread by a mosquito-like insect. The disease is widespread in Africa, the Near East and the United States although indigenous sheep show few symptoms of the disease. The disease appears in the wet season when breeding of the insects is at its height.

Symptoms

Following an incubation period of 2-4 days, symptoms commence with a high temperature. Animal becomes dull, off its feed, but is thirsty. The mucous membranes of the mouth and tongue and the skin of the lips and nose become inflamed. There is a discharge from the nose which later causes crust formation around it; the nasal mucous membranes become congested and ulcerated and blood may appear in the discharge and the mucous membranes of the mouth, tongue and lips become swollen and sometimes bluish. Sores may also develop. The animal has difficulty in swallowing and the mouth gives off a bad odour. The animal becomes lame and a red inflamed ring may appear around the top of the hoof.

Death, if it occurs, takes place within a week of symptoms appearing but mortality varies greatly from no mortality up to 90 percent. In any case recovery takes a long time.

At post-mortem lesions of the mouth and nose, as described, will be observed and the various body tissues will be covered with a gelatinous material with small haemorrhages in the muscles.

Diagnosis

While the symptoms and lesions described will suggest blue tongue, it may be difficult to distinguish it from other diseases but blood samples with chemicals added to prevent coagulation (see Appendix 10) from a number of animals in the flock should be sent on ice to the laboratory.

Treatment, Control and Prevention

No specific treatment is available but affected animals should be carefully looked after and kept out of the sun.

Control and prevention consists of annual vaccination one month before the usual season of insect breeding and, where possible, flocks should be grazed in areas free of the insects.

Brucellosis of Sheep and Goats

(Section 83)

Nature and Occurrence

A disease thought to be present in sheep and goats in most tropical countries which is spread through contaminated feed and water as a result of excretion of organisms by infected animals mainly after calving or abortion. It is caused by a bacterium (Brucella melitensis) which is similar to Brucella abortus (Section 31).

The disease causes undulant fever (Malta fever) in man, most often contracted through drinking milk or eating cheese made from the milk of infected animals.

Symptoms

Symptoms vary greatly - sometimes there are none, sometimes there is a loss of condition, coughing and lameness. After a flock becomes infected abortions occur with retained after-births and reduced milk yields.

Diagnosis

Diagnosis is difficult because of the indefinite symptoms and must be confirmed by the laboratory from samples of milk and blood or specimens of placenta, foetus or vaginal discharge.

Treatment, Control and Prevention

Are similar to those employed in the case of Br. abortus, including the testing of all animals in the flock (Section 31). Vaccination may be used in certain circumstances.

* * * * *

Another type of brucellosis of sheep occurs in certain countries, caused by Br. ovis. This is characterized by epididymitis in rams. The disease also causes inflammation of the testicle - affected animals being infertile or sterile. It can be controlled by the culling of infected rams for slaughter and by vaccination.

Contagious Agalactia of Sheep and Goats
(Section 84)

Nature and Occurrence

An infectious disease of sheep and goats (also sometimes of buffalo calves) caused by a small micro-organism (Mycoplasma agalactiae). It is found in most Mediterranean and Near East countries but also elsewhere especially where sheep and goats are used for milk production.

The disease is spread by direct contact between healthy and infected animals during milking, and by inhalation and ingestion of contaminated material.

It is most common when ewes are lactating.

Symptoms

Characteristic symptoms include high temperature; reduced milk production; mastitis; milk filled with clots and yellow/green in colour and the udder swollen and painful. Animals become emaciated and lame and stiff from joint infection. Conjunctivitis of eyes is common with the formation of opacities. Abortions may occur.

Outbreaks usually affect about 25 percent of the flock but deaths are usually less than 10 percent.

Diagnosis

Diagnosis is made from the history and symptoms. Confirmation of disease can be obtained from the laboratory on submission of samples of infected milk, discharge material from the eyes and fluid from the joints.

Treatment, Control and Prevention

Where it is economically justified, the antibiotic tylosin can be used when available.

Infected animals should be removed from the flock and methods of clean and hygienic milk production strictly followed.

Vaccination against the disease has been effective in some countries.

Contagious Caprine Pleuro-pneumonia (CCPP)
(Section 85)

Nature and Occurrence

A specific disease of goats very similar to contagious bovine pleuro-pneumonia (CBPP) (see Section 32) widespread in tropical Africa and Asia. It is caused by a small micro-organism similar to that causing CBPP. It is spread by direct and indirect contact between healthy and infected animals through nasal discharges.

Symptoms

In the acute form symptoms are those of pneumonia but in the chronic form there is a chronic cough, severe loss of condition and enteritis.

Very high mortality (60-100 percent) may occur in outbreaks of the disease.

On post-mortem typical pneumonic lesions are seen in all stages. Lungs are swollen, heavy and vary in colour, being solid with congestion. Pleurisy is usually present with fluid in the chest cavity. Affected areas of lungs are covered with a yellowish deposit which may also be found in the heart sac.

The spleen is enlarged and bronchial lymph nodes swollen.

The lesions of CCPP differ from CBPP in that pieces of dead tissue separating healthy lung tissue are not seen.

Diagnosis

Diagnosis is usually based on history, symptoms and lesions. Confirmation of disease can be obtained in the laboratory from specimens of the fluid from the chest cavity.

Treatment, Control and Prevention

Treatment is not practical and if the disease is not widespread, infected animals are best slaughtered.

Vaccination is carried out in some countries.

Entero-toxaemia (Pulpy Kidney Disease)
(Section 86)

Nature and Occurrence

A disease of sheep and goats often resulting from changes in diet, especially from poor to good. It is caused by the toxins produced during growth by one of the group of organisms called Clostridium. These organisms gain entry from contaminated grazing and if the diet has changed from poor grazing to rich feeding with silage or grain, for example, the organism quickly multiplies and releases the toxin.

Symptoms

Animals may be found dead or observed with sudden unsteady or uncoordinated movements such as muscular tremors or head thrown back. Salivation, diarrhoea and prostration follow.

On post-mortem, the carcase will be found blown up with gas and the kidneys pulpy.

Diagnosis

For confirmation of disease a piece of fresh intestine (with no preservative) should be sent to the laboratory, together with a slide of intestinal contents. Alternatively the intestinal contents can be squeezed into a sterile bottle and a drop or two of chloroform added.

Treatment, Control and Prevention

Treatment is ineffective. A good vaccine is available which should be used in areas where the disease is found. Marked and rapid changes in diet should be avoided.

Goat Pox
(Section 87)

Nature and Occurrence

A disease of goats caused by a virus. Similar viruses cause sheep pox and lumpy skin disease in cattle. The disease is epizootic in Africa but also occurs in Asia and parts of Europe and is spread by direct and indirect contact between healthy and infected animals and possibly by soft ticks or other arthropods.

Symptoms

The disease starts with a high temperature; running at the eyes and nose; loss of appetite and the appearance of papules on the skin and mucous membranes. There is acute irritation. Crusts form on the papules which become ulcers and on which crusts later form. These crusts drop off leaving animals "pock marked".

Diagnosis

Diagnosis is generally obvious from the history and symptoms. Crusts can be sent to the laboratory for confirmation of the disease.

Control

Good vaccines are available.

Sheep Pox
(Section 88)

Nature and Occurrence

A highly infectious disease of sheep caused by a virus. A similar virus causes goat pox (see Section 87 above). Is epizootic in sheep in the northern parts of Africa and in Asia.

Symptoms

Disease is spread by direct and indirect contact between healthy and sick animals. It may be spread through dust and by the bites of an insect. An acute infection is characterized by high temperature; discharge from eyes and nose; drooling at mouth; off feed and inability to graze. Red papules form which turn into vesicles which are often haemorrhagic in the mouth and between the hind legs and on other areas where the skin is thin.

The vesicles become crusted and scabs form. When these fall off pock marks are left. The animal is severely irritated.

Symptoms may be severe and mortality high in animals brought into an epizootic area.

Diagnosis

Diagnosis is generally obvious from the history and symptoms.

Control

A good vaccine is available and this should be used in all epizootic areas.

* * * * *

A clinically similar disease is Contagious pustular dermatitis which principally affects lambs. Pustules are usually confined to the lips of lambs and the udders of ewes. The disease is rarely fatal unless it is so severe as to interfere with suckling or unless serious secondary infections follow. Lesions occasionally occur on the feet causing lameness and possible confusion with foot-and-mouth disease. The disease runs a course of 3-4 weeks and recovery is complete being followed by strong immunity. An effective vaccine is available.

Foot Rot in Sheep
(Section 89)

Nature and Occurrence

A severe infectious condition affecting the feet of sheep. Although clinically very similar to foot rot in cattle, it is basically due to a different bacterium, Bacteroides nodosus, together with F. necrophorus. The lesions caused by these organisms usually become invaded by other pus producing organisms. The disease which occurs worldwide is most common in damp areas and in the wet season when the organisms enter through abrasions.

Symptoms

Lameness may be severe causing recumbancy and loss of condition. Examination of the feet shows a dermatitis which rapidly develops into ulceration and separation of the hoof, with necrosis and later pus formation. There is a characteristic smell.

Diagnosis

Differentiation from non-specific foot disease is difficult.

Treatment, Control and Prevention

Some control is obtained by walking the flock through foot baths of 10 percent formalin. Dry conditions will help recovery as will good hoof trimming. Treatment of animals with antibiotics will control severe infections.

Vaccines are available but are not generally used.

Nairobi Sheep Disease

(Section 90)

Nature and Occurrence

A tick-borne virus disease of sheep and goats (more severe in sheep), found in East and southern Africa and spread by a number of tick species, including Rhipecephalus appendiculatus, the tick vector of East Coast fever. It is thought that rats also carry the infection.

Indigenous animals are highly resistant but imported animals quickly succumb to the disease and may die.

Symptoms

The symptoms are characterized by high temperature, nasal discharge with crust formation, and intestinal pain with diarrhoea which is sometimes blood stained. Ewes may abort. Death may take place 4-7 days after onset of symptoms.

Post-mortem shows inflammation of and haemorrhages in the gastro-intestinal tract particularly in the large intestines.

Treatment, Control and Prevention

There is no treatment. A good vaccine is available and is used. Chemical control of ticks and restrictions on sheep movements should also be employed.

Peste des Petits Ruminants (PPR) - Kata
(Section 91)

Nature and Occurrence

A serious viral disease of goats and sheep (the former are more susceptible). Sometimes referred to as pseudo-rinderpest. It is found in most parts of the tropics and is considered epizootic in West Africa. It is spread by direct and indirect contact through infected nasal discharges. Cattle and buffaloes are not affected.

Symptoms

The disease is very similar to rinderpest in cattle and buffaloes. It commences with a high temperature and a serous nasal discharge which later becomes more pronounced and has pus in it. Diarrhoea also develops.

Animals may die within the first week after the onset of symptoms - usually from pneumonia. In animals which survive, a dermatitis may develop in the lips with crust formation.

Kids are more severely affected than adults.

On post-mortem lesions are somewhat similar to those in rinderpest with mouth, nasal, pharyngeal and vaginal inflammation. The abomasum and intestines will also be inflamed sometimes with haemorrhages and striping. Lungs may also be affected.

Diagnosis

Diagnosis is made from symptoms and post-mortem. Confirmation is made in laboratory from tissues (e.g. lungs in 10 percent formalin).

Prevention

To prevent the spread of the disease affected animals should be slaughtered, movement of animals restricted and animals quarantined before their introduction into disease free flocks.

Certain vaccines against this disease are now available and, under the supervision of the Veterinarian, may be used.

Rift Valley Fever
(Section 92)

Nature and Occurrence

A viral disease of cattle, sheep, goats and camels and man spread by mosquitoes and occurring in Africa south of the Sahara (although more recently in Egypt), and often in epizootics following seasons of heavy rain and increased breeding of mosquitoes.

Imported exotic animals are much more susceptible to the disease than indigenous animals.

Symptoms

The disease is more severe in sheep and goats than cattle and in young lambs, kids and calves than in adult stock. Mortality in young animals may reach 100 percent.

Other symptoms include high temperature; dullness; lack of appetite; discharges from nose and eyes, which are sometimes blood-stained and with pus; respiratory difficulties and prostration.

In older animals a high temperature, respiratory difficulties and intestinal pain with bad smelling, blood-stained or watery diarrhoea may occur. Pregnant animals may abort and milk production decreases.

The fact that disease is present in sheep, goats and cattle at the same time and that human beings associated with them are sick is a good indication of the existence of Rift Valley fever.

Diagnosis

At post-mortem examination carcases may show haemorrhages on the surface of the abdominal cavity and on organs, blood-stained fluid in body cavities and an enlarged, yellow and haemorrhagic liver. The intestinal tract may be inflamed and filled with blood.

Lymph nodes throughout the carcase will be enlarged and haemorrhagic, and haemorrhages will be seen on kidney, bladder and spleen. Jaundice may also be seen in the fat of the carcase. Tests in the laboratory made on samples of serum and liver slices in 10 percent formalin will confirm the diagnosis.

Treatment, Control and Prevention

Treatment is not effective.

Annual vaccination against the disease is effective but pregnant ewes should not be vaccinated.

Livestock should, as far as possible, be kept from low-lying wet areas infested with mosquitoes.

Other Diseases of Sheep and Goats
(Section 93)

Diseases to which sheep and goats are also susceptible are described in the Sections concerned with Diseases of Cattle and Buffaloes, as follows:

Diseases caused by Bacteria

Anthrax (Section 27)
Blackquarter (Section 28-1)
Malignant Oedema (Section 28-2)
Botulism (Section 29)
Haemorrhagic Septicaemia (Section 34)
Infectious Conjunctivitis (Section 35)
Johne's Disease (Section 36)
Leptospirosis (Section 37)
Metritis (Section 38)
Dermatophilosis (and Lumpy Wool Disease) (Section 39)
Tetanus (Section 40)

Diseases caused by Viruses

Foot and Mouth Disease (Section 44)
Rabies (Section 48)
Rinderpest (Section 49)

Diseases caused by Protozoa and Rickettsia

Ticks (Sections 52 - 56)
Heartwater (Section 59)
Flies (Section 65)
Trypanosomiasis (Section 66)

Diseases caused by Parasites

External Parasites (Section 69)
Mange (including sheep scab) (Section 70)
Others (Section 71)
Internal Parasites (General) (Section 72)
Flukes (Section 73)
Tape Worms and Measles (Section 74)
Round Worms (Section 75)

Possible Diseases as Indicated by Symptoms (Section 94)

As in the case of diseases of cattle and buffaloes for which a chart was compiled (Section 80) indicating possible diseases from the symptoms observed by the A.H.A., a chart has been compiled for the diseases of sheep and goats.

Possible Diseases of Sheep and Goats Indicated from Symptoms

	Section	Found dead – Sudden death	Lying down – Usually High temp. – Dies	Coughing – Nasal Discharge	Breathing difficulty	High temperature	Off feed	Loss of condition – Emaciation	Reduced milk	Lameness, paralysis, Nervous symptoms	Diarrhoea scouring	Red urine	Pale mucous membranes	Mouth lesions	Lambs/Kids dying	Skin, hair, wool lesions	Abortions	Swellings – head or body	Running eyes	Abdominal pain
Blue Tongue	82			X		X	X	X		X								X		
Brucellosis	83			X				X	X	X							X			
Contagious Agalactia	84					X		X	X								X	X	X	
Contagious Caprine	85			X				X			X									
Entero-toxaemia	86	X								X										
Goat Pox	87					X	X									X			X	
Sheep Pox	88			X		X	X							X		X				
Nairobi Sheep Disease	90			X		X					X						X			
PPR - Kata	91		X	X		X					X			X	X					
Rift Valley Fever	92	X		X	X	X	X				X						X		X	
Anthrax	27	X				X														
Blackquarter	28-1	X	X							X	X				X			X		
Botulism	29		X							X										
Brucellosis	31																			
Foot Rot	33									X										
Haemorrhagic Septicaemia	34	X	X	X														X	X	
Infectious Conjunctivitis	35																		X	
Johne's Disease	36																			
Leptospirosis	37	X										X	X		X					
Malignant Oedema	28-2	X	X												X					
Metritis	38																			
Dermatophilosis and Lumpy Wool	39															X				
Tetanus	40									X										

	Section																			
Vibriosis	42														X					
Foot-and-Mouth Disease	44									X										
Rabies	48									X										
Rinderpest	49																			
Ticks	56												X							
Heartwater	59	X	X			X	X			X	X									
Flies	65																			
Trypanosomiasis	66					X	X	X	X									X		
External Parasites	69												X							
Mange (Sheep scab)	70															X				
Others (Lice)	71															X				
Internal Parasites	72			X						X			X							
Flukes	73																			
Tape Worms/Measles	74																			
Round Worms	75			X				X			X		X					X		
Plant Poisoning	79	X								X	X									
Nasal Bot	71			X				X												
Wooden Tongue	43																	X		
Bloat	77										X							X		X
Mineral Deficiencies	79							X	X				X							
Malnutrition	79												X							

CHAPTER 11

DISEASES OF PIGS

Introduction
(Section 95)

While pigs are susceptible to many of the diseases described under 'Diseases of Cattle and Buffaloes', there are a number of important diseases specific to pigs. These are:

Swine fever or Hog Cholera (Classical swine fever)
African swine fever
Swine erysipelas
Swine pox

Descriptions of these diseases follow, after which a list will be found of those diseases, described under 'Diseases of Cattle and Buffaloes' to which pigs are also susceptible and which suffer from them in a way similar to cattle and buffaloes.

Swine Fever (Hog Cholera)
(Section 96)

Nature and Occurrence

A highly infectious disease of pigs caused by a virus different from the virus causing African swine fever. It is sometimes referred to as "classical swine fever" to distinguish it from African swine fever and occurs world wide including most countries in the tropics.

The disease is most commonly spread by ingestion of contaminated material such as pork products used to feed pigs but it can also be spread by inhalation. The virus can be carried long distances mechanically - even by birds.

Symptoms

After a rise in temperature pigs are dull, stop feeding and become constipated. Later, diarrhoea develops and a mucopurulent discharge from the eyes and sometimes nose is seen. Death usually takes place within a week but in less acute cases patches of discolouration which soon become haemorrhagic, appear on the skin, especially on the abdomen. The ear tips may become necrotic.

Pigs become weak especially in hindquarters, stagger and show nervous symptoms.

Diagnosis

On post-mortem small haemorrhages are found on the serous membranes on the inner wall of the chest, lungs, kidneys, heart, lining of intestinal cavity, windpipe and larynx. A characteristic lesion is the "button" ulcers which occur in the large intestine near the junction with the small intestine. Lymph nodes are swollen and red.

In the lungs widespread areas of pneumonia, generally haemorrhagic, may be seen; the surface of the affected parts of the lung is covered with a fibrinous deposit.

In the past morbidity and mortality rates have been high but recent outbreaks seem milder and slower spreading.

Diagnosis is very difficult without laboratory assistance and it is impossible to distinguish between this classical form of swine fever and African swine fever without making detailed laboratory tests.

Treatment, Control and Prevention

There is no treatment. When the disease gains entry into a free area the only reliable method of eradication is by slaughter of all infected and in-contact pigs. At the same time quarantine measures must be strictly enforced and movement of pigs stopped.

For prevention of the disease a programme of vaccination can be implemented. Such a programme is not straight-forward or easy and must be carefully controlled by the Veterinarian.

African Swine Fever
(Section 97)

Nature and Occurrence

An acute, highly contagious, viral disease of domestic and wild pigs, which is found in south, east and west Africa and Spain, Portugal, Brazil and Italy. In Africa the wart hog, bush pigs and other wild pigs act as reservoirs of infection. The virus can be spread by the bites of ticks, ingestion of contaminated feed and close contact with infected pigs.

Symptoms

After 5-9 days incubation the pig develops high temperature, becomes dull, goes off feed. This is followed by paralysis of hindquarters, a bluish discolouration of snout, ears and legs, diarrhoea and haemorrhages in skin.

Discharges will also occur from eyes and nose.

Death occurs a week after symptoms first appear.

In some cases the condition takes a chronic form with periods of high temperature, swellings of joints and finally death occurring after several months.

On post-mortem the bluish areas of discolouration stand out, all organs and lymph nodes are haemorrhagic. The intestinal tract is also inflamed and haemorrhagic and the spleen enlarged. Haemorrhages are also present on the outer wall of the heart and the linings of the heart cavities.

Diagnosis

Diagnosis is made from the history, symptoms and post-mortem lesions, but confirmation must be obtained from the laboratory for which blood samples in citrate or OCG are required (see Appendix 10).

Treatment, Control and Prevention

There is no treatment and no vaccine available for immunization.

Domestic pigs should be well isolated from wart hogs and other wild pigs. If disease occurs in domestic pigs it is best to slaughter all pigs, burning or burying the carcases in lime and not restocking for at least 4 months.

Communal grazing of pigs should not be permitted. The main thing is to keep domestic pigs from all contact with wild pigs.

Swine Erysipelas
(Section 98)

Nature and Occurrence

A disease of pigs in many countries caused by a bacillus Erysipelothrisi rhusiopathiae which is often present in healthy pigs. Attacks and outbreaks are often associated with changes of diet or management.

Symptoms

In acute form pigs, especially young animals, may die suddenly with few symptoms. In other cases high temperature with diamond shaped purple patches appearing on skin. Pigs are dull, off feed, walk stiffly, may vomit and have diarrhoea.

In the chronic form heart lesions occur and cause lassitude, heavy breathing and bluish mucous membranes: lameness becomes severe and pigs become undersized and stunted. Chronic cases seldom die of the disease but remain non-productive.

Treatment, Control and Prevention

Penicillin is very effective in treating this disease. A good vaccine is available to prevent the disease.

Swine Pox
(Section 99)

Nature and Occurrence

A disease of pigs caused by a virus, similar to those causing pox in cattle, sheep, goats and camels. The disease is considered to be associated with the presence and bites of pig lice (Haematapinus suis).

Symptoms

Symptoms are seldom severe. Crusts form all over the body but especially on the abdomen and ears causing discomfort. There is occasionally mild fever.

Control

Control is usually effected through the control of lice by the application of crude oil (even used motor oil) or insecticides or acaricides to the pigs. Treated pigs must be kept out of the sun for two days.

Other Diseases of Pigs

(Section 100)

Diseases to which pigs are also susceptible and which are described under 'Diseases of Cattle and Buffaloes' are:

Diseases caused by Bacteria

Anthrax (Section 27)
Blackquarter (Section 28-1) - rarely
Malignant Oedema (Section 28-2)
Botulism (Section 29)
Haemorrhagic septicaemia (Section 34)
Leptospirosis (Section 37)
Tetanus (Section 40)
Tuberculosis (Section 41)

Diseases caused by Viruses

Foot-and-Mouth Disease (Section 44)
Rabies (Section 48)
Rinderpest (Section 49)*

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* Rinderpest only causes clinical disease in Asiatic pigs. Although pigs elsewhere in the world may become infected they remain clinically normal. The reason for this is not understood.

Diseases caused by Protozoa

Coccidiosis (Section 67)
Tick-borne Diseases (including Babesiosis) (Sections 52-56 and 60)
Trypanosomiasis (Sections 65 and 66)

Diseases caused by Parasites

External Parasites (Section 69)
Mange (Section 70)
Internal Parasites (Section 72)
Round Worms (Section 75)
Tape Worms and Measles (Section 74)

Possible Diseases as Indicated by Symptoms
(Section 101)

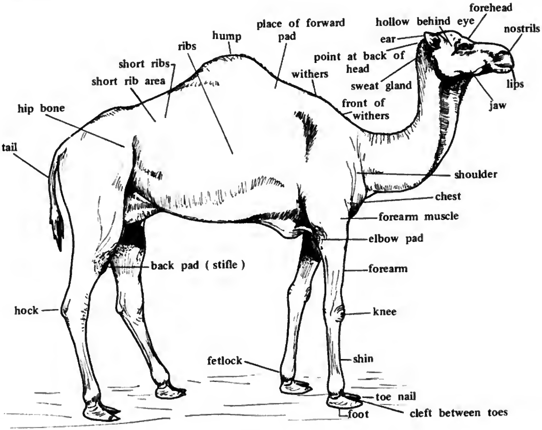
As in the case of cattle and buffaloes and sheep and goats, the following chart indicates possible diseases in pigs from the symptoms observed by the A.H.A.

Possible Diseases of Pigs Indicated by Symptoms

(Section 101)

Mouth Lesions	Death in Young Pigs	Abortions	Sterility - Infertility	Swellings, Lumps	Skin Lesions, Discoloured	Emaciation	Breathing Difficult	Mucous Membranes Inflamed	Lameness, Stiffness, Leg Weakness, Paralysis	High Temperature	Vomiting	Diarrhoea - Scouring Possible Haemorrhage	Constipation	Coughing - Discharge from Nose (Sore eyes)	Off Feed	Found dead - Sudden Death	Main Symptoms	Sect.
					×				×	×		×		×	×	×	African Swine Fever	(97)
	×	×	×		×				×	×	×	×		×	×	×	Swine Erysipelas	(98)
	×	×			×				×	×	×	×	×	×		×	Swine Fever	(96)
	×			×	×					×							Swine Pox	(99)
				×	×					×	×	×				×	Anthrax	(27)
					×					×			Rare			×	Blackquarter	(28)
									×		×					×	Botulism	(29)
	×	×	×														Brucellosis	(31)
										×		×		×		×	Haemorrhagic Sept.	(34)
	×	×	×						×	×	×				×		Leptospirosis	(37)
				×	×				×	×						×	Malignant Oedema	(28-2)
		×															Metritis	(38)
		×					×		×						×		Tetanus	(40)
				×		×			×	×		×		×			Tuberculosis	(41)
×					×				×	×							Foot-and-Mouth Dis.	(44)
				×		×			×								Foot Rot	(33)
								×				×		×	×		Rabies	(48)
×										×		×		×			Rinderpest	(49)
						×						×					Coccidiosis	(67)
																	Tick-borne Dis.	(52-56)
									×	×					×		Babesiosis	(60)
		×		×		×				×					×	×	Trypanosomiasis	(66)
																	External Parasites	(69)
					×												Mange	(70)
					×												Ring Worm	(76)
						×			×			×					Internal Parasites	(72)
												×					Round Worms	(75)
														×			Tape Worms-Measles	(74)
	×			×						×				×			After Castration	
	×		×			×			×		×	×					Bad Feeding	(79)
							×			×							Heat Stroke	(79)

Fig 39 - POINTS OF THE CAMEL. (See sections 27 - 80)



CHAPTER 12

DISEASES OF CAMELS

Introduction
(Section 102)

Less is known about the diseases of camels than about the diseases of the other species dealt with in this Manual. It would appear, however, that in fact the camel suffers from fewer diseases than other species of domestic livestock and epizootics amongst them are rare.

However, it is generally agreed that the camel suffers in particular from three diseases and two non-infectious conditions. These are:

Mange
Pox
Trypanosomiasis
Inflammation of soft palate
Camel paralysis

The camel is also susceptible to a number of the diseases described under 'Diseases of Cattle and Buffaloes' and these are listed together with their Section numbers, for easy reference, following the descriptions of the above disease conditions.

Mange of Camels
(Section 103)

Nature and Occurrence

A parasitic disease of camels considered to be second in importance to trypanosomiasis. It is caused by a mite (Sarcoptes scabiei) and referred to as sarcoptic mange. The disease spreads rapidly in a herd by direct or indirect contact through the use of infected saddles, harness, bedding, etc. The disease is more common in winter time when the camels' hair is long.

Symptoms

The disease spreads quickly over the whole body starting around the head. The affected areas become swollen, hard, hairless and wrinkled especially over the hindquarters, thigh and hock joint areas.

The animal is greatly irritated, rubs itself against objects thus spreading the disease.

Diagnosis

Diagnosis is made from the symptoms. Skin scrapings will confirm the presence of the mite.

Treatment, Control and Prevention

Infected animals are isolated, clipped, washed and scrubbed with soap and water and an acaricidal dressing applied. The camel is difficult to dip but hand dressing and spraying are effective.

Clippers, harness, saddles, etc. which have been in contact with infected animals should be sterilized or soaked in insecticides or acaricides.

The Veterinarian will advise on the methods of dressing and the acaricides to be used.

Camel Pox
(Section 104)

Nature and Occurrence

A mild disease of camels caused by a virus which is infectious for man and is spread by direct and indirect contact.

Symptoms

Lesions usually appear on the mucous membranes of the mouth with swelling of the lips and the formation of papules. Papules turn into vesicles then into pustules on which crusts form. Crusts fall off leaving pock marks.

Animals suffer severe irritation.

In young animals symptoms generally more marked. Older animals may lose condition and have reduced milk yield.

Diagnosis

Diagnosis generally obvious from history and symptoms.

Treatment, Control and Prevention

Camel owners often protect their young animals by taking crusts, mixing these with milk and rubbing the resultant fluid on the lips of the young camel which have been pricked.

Trypanosomiasis of Camels (Surra)
(Section 105)

Nature and Occurrence

A protozoal disease of camels but transmitted by biting flies and not by tsetse flies as in cattle (see Section 65). The causal organism is a trypanosome (Trypanosoma evansi) transmitted by biting flies such a Tabanus and Stomoxys, prevalent along river banks and at watering points in arid regions.

Symptoms

The disease occurs in a chronic form, females showing a drop in milk production and sometimes aborting; and all animals showing a loss of condition, off feed, weakness, emaciation, prostration and eventual death. In some cases the animal may be infected and sick for some 3-4 years before dying.

Diagnosis

Diagnosis is generally based on the symptoms, the disease being confirmed in thick blood smears taken from the tip of the ear of the animal.

Treatment, Control and Prevention

The disease can be effectively treated by a number of trypanocidal drugs, advice on which and their use will be given by the Veterinarian.

Non-Infectious Conditions

Inflammation of Soft Palate
(Section 106)

Nature and Occurrence

A non-infectious condition in which injury is caused to the soft palate. This occurs because camels are able to protrude their soft palates beyond their lips, thus showing a balloon-like organ to which sharp objects or fighting can cause injury leading to infections.

Symptoms

The throat becomes swollen and the camel is unable to swallow and has difficulty in breathing.

Treatment, Control and Prevention

Amputation of the inflamed part of the palate is recommended since this gives the animal immediate relief and causes little bleeding, but the Veterinarian should be consulted before this is attempted.

Camel Paralysis
(Section 107)

Nature and Occurrence

Paralysis in camels caused by tick toxicosis occurs in N.E. African countries. It is associated with infestations of the tick Hyalomma dromedarii (see Section 63).

Other Diseases of Camels
(Section 108)

Diseases to which camels are also considered to be susceptible and included in the diseases described under 'Diseases of Cattle and Buffaloes' are:

Diseases caused by Bacteria

Anthrax (Section 27)
Blackquarter (Section 28-1)
Botulism (Section 29)
Brucellosis (Section 31)
Haemorrhagic Septicaemia (Section 34)
Leptospirosis (Section 37)
Malignant Oedema (Section 28-2)
Tetanus (Section 40)
Tuberculosis (Section 41)

Diseases caused by Viruses

Foot-and-Mouth Disease (Section 44)
Rinderpest (Section 49)

Diseases caused by Protozoa and Rickettsia

Ticks (Sections 52 - 56)
Tick-borne Disease (Sections 57-64)
Flies (Section 65)

Diseases caused by Parasites

- External Parasites - Introduction (Section 69)
- Other External Parasites (Section 71)
- Internal Parasites - Introduction (Section 72)
- Flukes (Section 73)
- Tape Worms (Section 74)
- Round Worms (Section 75)

PART 5

VETERINARY PROCEDURES RESTRAINT OF ANIMALS TECHNIQUES AND OPERATIONS

CHAPTER 13

PROCEDURES AND PREPARATION OF SPECIMENS

Use of thermometer
(Section 109)

The use of a thermometer is of great value in the indication it gives of an animal being sick. It is also of value in helping to diagnose the disease from which the animal is suffering.

Between healthy animals there may be slight variations in normal temperatures due to climate, oestrus, physical activity and food intake, which may raise the normal temperature of healthy animals. Just prior to death the temperature may drop.

The thermometer is usually a hollow glass tube filled with mercury or other liquid which expands when warmed or heated. When subject to a certain temperature it expands and moves up the tube to the level for that temperature which is marked on a scale in degrees and tenths of a degree.

The scale can be in Celsius or Fahrenheit.

In using a thermometer the following procedure should be followed:

(i) shake the thermometer so that the liquid is at the bottom of the scale;

(ii) moisten the thermometer with water or vaseline;

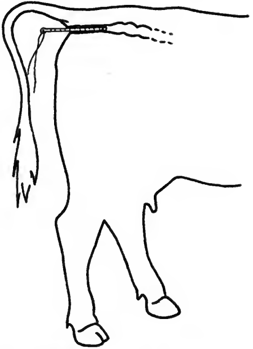


Fig 40 - THERMOMETER IN RECTUM. (See section 109)

(iii) gently insert thermometer into rectum about 10cm parallel with the backbone;

(iv) hold in the rectum at least 1-2 minutes;

(v) withdraw thermometer, read, record the temperature, clean and disinfect the thermometer and replace in protective case.

It is a good arrangement to fix about 50cm of string to the thermometer by means of adhesive tape, the other end being attached to a paper clip. This is clipped to the animals hair when the thermometer is inserted so that if it falls from the rectum it will not break on the ground.

See Appendix 3 for rectal temperatures of normal, healthy domestic animals.

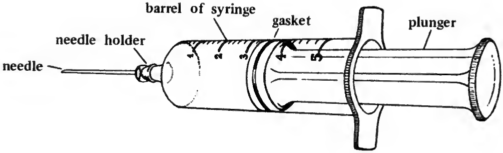
Taking Pulse Rate
(Section 110)

The normal pulse rates of animals are given in Appendix 4. The pulse reflects the beating of the heart and if it increases its beat above normal this may indicate disease.

The pulse is reflected in the arteries and the rate is ascertained from counting the beats per minute in the caudal artery in the tail or the facial artery on the cheek, the carotid artery in the neck or the femoral artery inside the thigh.

Apart from the pulse rate, it is also possible to recognize irregularities in the heart beat and to distinguish between a strong or weak heart action.

Fig 41 - THE SYRINGE AND ITS PARTS. (See section 111)



Use of the Syringe
(Section 111)

There are many types and sizes of syringes in both glass or plastic. The Veterinarian will advise on the best type for use for any particular vaccination or drug administration.

All syringes consist of a barrel, a plunger, a metal or plastic needle holder or nozzle and, for plastic syringes, a gasket. There are two standard kinds of needle ("Luer" and "Record") which only fit the corresponding syringes and it is important that the type of needle matches the syringe. The capacity of the syringe should be approximately the size of the injection to be given. Some syringes will automatically or semi-automatically give a fixed dose. Needles also vary in size both in their length and their gauge (diameter). The Veterinarian will also advise on the most suitable type of needle for the syringe and for the purpose for which it is being used.

Care of Syringe

Before use, whenever possible, a syringe should be sterile (i.e. free of micro-organisms) and free of chemical contaminants.

In the field the same syringes and needles have to be used repeatedly so that great care must be taken to clean the syringe after each use.

The syringe should be taken apart and the parts soaked and then cleaned in cold or warm (not hot) water using, if available, a special brush for the purpose.

Needles should also be carefully cleaned using a cleaning wire for the inside, any with damaged points being re-sharpened or, if past repair, thrown away. Wherever possible a freshly sterilized needle should be used for each animal to avoid transferring infection from one animal to another. In the field this can be done by keeping a saucepan boiling on a fire, used needles being dropped in and boiled for 5 minutes before being taken out (with forceps) and re-used.

Sterilizing syringes and needles is best done in a hot air oven at 160°C for 60 minutes or in a pressure steam chamber (autoclav) at 121°C for 15 minutes. In the field boiling water is adequate provided that syringes are boiled for 10 minutes at low altitudes and for 20 minutes at over 2,000 metres (6,000 ft) elevation. A piece of cloth or cotton wool should be placed on the base of the sterilizer, especially if glass barrelled syringes are being boiled.

After sterilization syringes and needles should be carefully handled with clean dry hands, reassembled and placed in a sterile container.

Syringes and needles can be sterilized by the use of chemicals such as alcohol but this is not so satisfactory as sterilization by heat. Chemicals should never be used for syringes and needles which are going to be used for vaccines made with living organisms or for tuberculin testing.

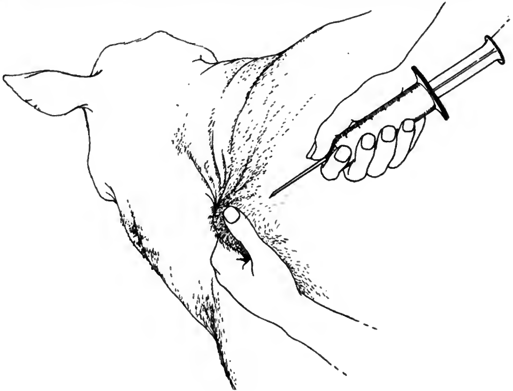


Fig 42 - POSITIONING A SYRINGE WITH NEEDLE FOR AN INJECTION.

Injecting with Syringe

There are several ways of injecting drugs or vaccines into animals as follows:

(i) Sub-cutaneous - under the skin. A loose fold in the region of the dewlap or breast, side of neck or over the shoulder is picked up and the injection made.

(ii) Intramuscular - into the muscle. Muscles of hind leg or neck of cattle, sheep and goats are preferred. A needle 40-60 mm long should be used for this injection.

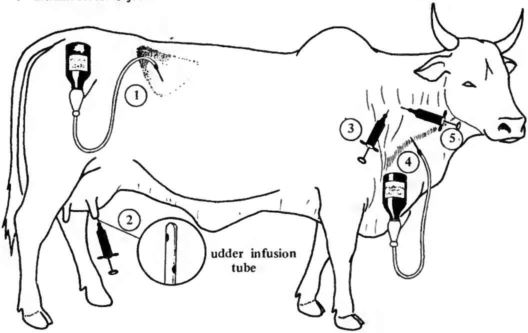
(iii) Intravenous - directly into the bloodstream, the drug thus taking effect almost immediately. In cattle, sheep and goats, injection is made into the jugular vein which is raised by tightening a cord around the neck of the animal. In Brahman and other lop-eared cattle an ear vein is conveniently used.

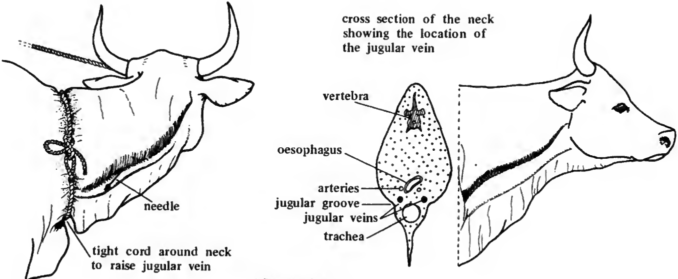
The needle by itself is first pushed through the skin and then into the vein (not the wall). When the blood flows out of needle the cord is released, the syringe attached and the drug slowly injected.

In pigs, after tying to a strong post by a rope around the upper jaw, a tape is placed tightly round the ear to raise the ear vein. With the needle in the vein the tape is loosened and the drug slowly injected.

Fig 43 - DIAGRAM OF INJECTION POINTS IN CATTLE (See section 109)

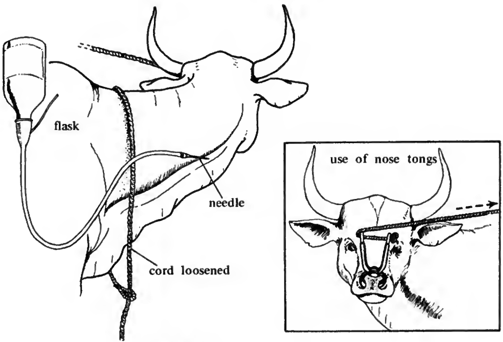
1 - intraperitoneal injection (right side only)
2 - infusions into udder
3 - subcutaneous injections
4 - intravenous injections into jugular vein
5 - intramuscular injection




cross section of the neck showing the location of the jugular vein
vertebra
oesophagus
arteries
jugular groove
jugular veins
trachea
needle
tight cord around neck to raise jugular vein

(See section 111)

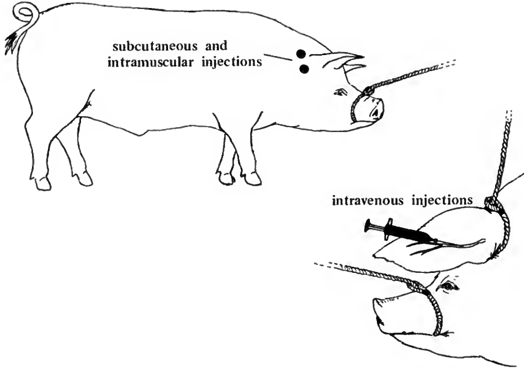
Fig - 44 - INTRAVENOUS INJECTIONS SHOWING LOCATION OF JUGULAR VEIN.



(See section 111)

Fig 45 - INTRAVENOUS INJECTIONS SHOWING USE OF RESTRAINT (Right) AND CORD (Left) FOR RAISING THE JUGULAR VEIN.

Fig 46 - INJECTION SITES FOR PIGS. (See section 111)



(iv) Intratracheal - into the windpipe the needle being inserted between two cartilages. This is used for control of lung worms.

(v) Rectal intrauterine - into the rectum, uterus or vagina. Drugs in liquid form, suppositories or tablets can be given this way after control of the animal has been effected.

Care of Vaccines, Antibiotics, Biologicals, etc.

(Section 112)

Storage

In time most vaccines, antibiotics and some drugs will deteriorate but if they are properly stored they will retain their potency until the expiry date printed on the label.

If the expiry date of vaccines is passed the vaccine should not be used. Instructions given on the vaccine regarding storage and care should always be carefully followed.

The factors governing good storage are:

(i) Temperature - Vaccines and antibiotics should be kept at correct temperatures, usually about 4°C. Keeping them in cars, for example, for long periods in the summer will result in high temperatures and deterioration of the product. Some products, such as viral vaccines, must be stored at very cold temperatures such as that of the deep freeze compartment of a refrigerator. Other vaccines may deteriorate under deep freeze conditions.

It is, therefore, very important to follow instructions regarding temperatures at which each product should be held.

(ii) All biological products suffer from direct sunlight - this must be avoided.

(iii) High humidity will adversely affect pills or medicine in capsule form unless the containers are tightly sealed.

(iv) The whole contents of a bottle of vaccine should be used once the bottle is opened. If any vaccine is left over it should be thrown away.

(v) Refrigerators will not function properly if the air inside cannot circulate. Cold air produced by the cooling element at the top and rear of the refrigerator must be allowed to fall. NEVER stack packets against the rear wall of a refrigerator but allow a 5 cm gap so that cold air can circulate.

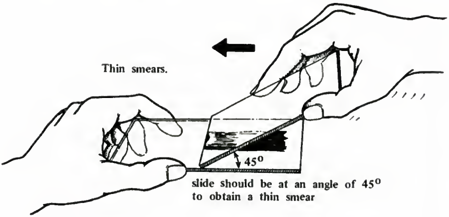
Preparation of Smears
(Section 113)

In order to see many of the organism which cause disease under the microscope it is necessary to prepare a "smear".

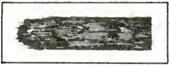
Taking smears is a very important duty of the A.H.A.

A smear is a very thin layer of blood, pus, lymph node, spleen or other organs on a glass slide taken from a live animal or one that has recently died.

Fig 47 - MAKING SMEARS. (See section 113)

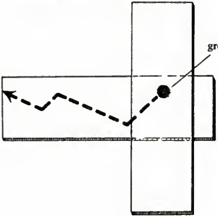

Thin smears.
45°
slide should be at an angle of 45°
to obtain a thin smear

Correct: with tail end thinning out



Wrong: tail end not thinned out

Making a Brain Squash Smear.



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Blood Smears

(i) The ear of the animal should be held and a blood vessel recognized.

(ii) The blood vessel is pierced with a sharp needle point.

(iii) A very small drop of blood is placed near the end of a clean glass slide.

(iv) Another clean slide is taken and the drop of blood on the first slide touched with an end of the second slide allowing the blood to spread evenly along the edge (see Fig. 47).

(v) The top slide is held at an angle of about 45° to the bottom slide which should be on a flat, level surface.

(vi) The top slide is pushed gently and smoothly along to the end of the bottom slide drawing the blood along behind it in the angle formed by the two slides.
A thin smear should then result.

(vii) The film is allowed to dry and then "fixed" in methyl alcohol and stained with a suitable stain.

(viii) The thinner the smear the better it is for examination under the microscope.

(ix) Two smears should always be made. When these have been taken they should be waved in the air to dry them.

(x) The two smears are placed together, back to back, with the blood surfaces outward, and wrapped in a thin piece of paper. Alternatively they can be separated by a match at each end, put face to face and carefully wrapped.

(xi) In certain diseases such as trypanosomiosis, redwater and malaria, it is also necessary to make "thick smears".

(xii) This is done by placing a small drop of blood on the middle of a slide, spreading it out in a small circle and allowing it to dry.

(xiii) The number or identity of each slide should always be referred to in the covering report.

Lymph Node Smears

(i) A syringe needle about 40 mm long is pushed through the skin over the prescapular lymph node.

(ii) The node is held firmly with one hand and the needle pushed into it with the other.

(iii) The thumb is placed over the free end of the needle to form a vacuum and held there while the needle is withdrawn. Alternatively, the needle may be attached to a syringe and lymph node material sucked into the needle by withdrawing the syringe plunger.

(iv) The lymph fluid collected at the point of the needle is blown or tapped out onto the end of a slide and a smear made as in the case of the blood smear.

Spleen Smear

(i) The spleen is cut along its middle.

(ii) A small piece of the spleen is placed on the edge of a slide and spread evenly over another slide.

Brain Squash Smear

(i) One of the two lobes of the brain should be cut across, half way along, and a small "pea" of material dug out of the greyish outer layer.

(ii) The "pea" should be squeezed between the centres of two slides which are firmly rubbed together and then slid apart sideways.

(iii) The slides are allowed to dry and both then sent to the laboratory.

Other Smears

Smears from other material such as pus are made in the same way by spreading evenly over a glass slide.

Taking Blood Samples
(Section 114)

a) Bleeding from the Jugular Vein

(i) Blood samples often have to be taken when, for example, animals are to be tested for pleuro-pneumonia or contagious abortion or for mineral deficiencies.

(ii) The hair over a small area over the jugular vein, preferably on the right side of the animal (i.e. in the groove just above the windpipe) in the lower half of the neck, is clipped and the area disinfected.

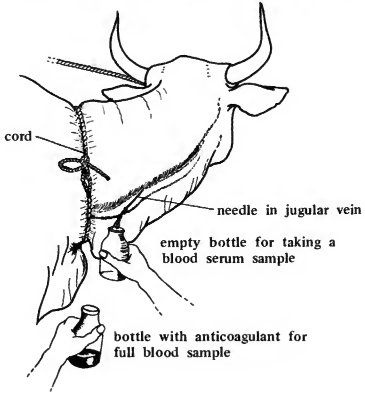
(iii) A cord with a slip knot is placed around the animal's neck and tightened; this raises the vein.

(iv) A wide bore needle with a sharp point is inserted into the vein keeping the needle almost parallel to it. The cord should be released as soon as collection is complete.

(v) Should the blood not flow freely the needle is withdrawn slightly and the point moved from side to side. Some technicians like to stab the vein sharply holding the needle at right angles to the vein.

(vi) An assistant holds a clean, dry bottle (or tube) opening it only long enough to half fill it.

Fig 48 - TAKING A BLOOD SAMPLE. (See section 114)


cord
needle in jugular vein
empty bottle for taking a blood serum sample
bottle with anticoagulant for full blood sample

(vii) The bottle or tubes should be placed in the shade for one hour to allow the blood to clot firmly. They should be despatched immediately this has been done.

b) Bleeding from the Tail Vein

This procedure is becoming increasingly used as it is more convenient when animals are in crushes and access to the jugular vein is difficult. Vacuum blood tubes are most convenient but blood can be collected using a syringe or even, with practice, with a needle alone. A sharp needle 25-35 mm and with a 0.8 mm bore should be used.

c) Bleeding from Ear Vein

Bleeding from the ear vein of cattle such as Brahman cattle is a convenient method when the animals are in a crush and unused to being handled.

Selecting Specimens for Diagnosis
(Section 115)

Before taking specimens from sick or dead animals it is necessary to keep in mind the following:

- Is the disease one communicable to man? (Section 27)
- Are any requirements laid down under the local Diseases of Animals Ordinance regarding (a) notification of disease and (b) isolation or movement of affected animals?

If an animal has died and there is no suspicion of a dangerous or notifiable disease a blood smear should be made by cutting off the ear lying nearest the ground, placing a drop of blood on a slide and preparing a thick blood smear as described in Section 113.

If the unopened carcase is near the laboratory it may be sent unopened but normally only blood, spleen and lymph node smears are sent.

When specific diseases are suspected certain specimens must be taken according to the disease so that the disease can be confirmed in the laboratory. The specimens required for each of the most important diseases and disease conditions will be found listed in Appendix 10. They should be sent through the Veterinarian or direct to the laboratory whichever is the correct procedure laid down.

Collecting Ticks and Flies
(Section 116)

(i) Ticks should be wrapped in soft paper and packed in a box or put into a bottle with 10 percent formalin.

(ii) Flies should be pinned through their broadest part to the small end of a cork which is then plugged into a bottle.

(iii) Information sent with ticks and flies should include:

  (a) date and exact locality where they were caught;

  (b) the animal on which they were feeding and the circumstances under which they were caught.

Preparation and Despatch of Specimens

(See Appendix 10)

(Section 117)

(i) About 100g of tissue from an organ should be sent unless otherwise instructed. It should be sealed in a plastic bag and sent on ice.

(ii) If only part of organ is diseased the margin between the affected and the unaffected part should be sent.

(iii) Material should be packed in watertight container (glass or plastic) surrounded by absorbent material to soak up any exudate which may escape from the material.

(iv) A covering letter should be sent with the package which, if possible, should be sent by the quickest means possible.

(v) If sent by post the regulations of the local Post Office should be followed. The package should be in a box or container well surrounded by absorbent material to stop it moving around. It should be clearly marked "Fragile - Handle with Care - Pathological Specimen".

(vi) If material is sent preserved in formalin, pieces measuring not more than 1 cm thick are immersed in at least ten times the volume of formalin (10 percent) than tissue.

Equipment
(Section 118)

The equipment required for the preparation and despatch of specimens will be found listed in Appendix 11.

CHAPTER 14

HOW TO DEAL WITH A CARCASE

Precautions
(Section 119)

(i) Before dealing with a carcase the diseases which are communicable to man should be remembered; the more common being anthrax, brucellosis, rabies, ringworm and mange. The same applies of course in the case of sick animals.

(ii) If anthrax is suspected the procedure outlined in Section 27 should be followed. If contagious abortion in cattle or buffaloes or Malta fever in goats is suspected, milk and fluids and the membranes passed at parturition should be avoided (see Section 31); if rabies is suspected, saliva must be avoided and if the A.H.A. has been in contact with the animal he should report immediately to a doctor or to a hospital (see Section 48); close contact with animals with suspected ringworm or mange should also be avoided.

Preparation of a Carcase for Post-Mortem Examination
(Section 120)

(i) Anthrax should first of all be excluded as the cause of death. If it is suspected no post-mortem should be made (Section 27).

(ii) If the hide or skin is required this should be taken off as described in Section 140 and laid out. It can then be used as a clean place to lay the organs on as they are removed from the body.

(iii) The carcase is then laid on its right side.

(iv) The muscles holding the forelimb in place are cut and the forelimb laid back clear of the ribs.

(v) The groin is cut into, the ligaments of the hip joint severed and the hind leg laid back.

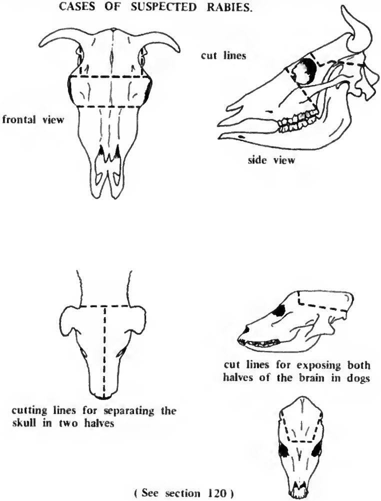
(vi) If the chest or belly has not been skinned this should be done.

(vii) A knife is inserted between the ribs, near the backbone and slid along the breastbone. It is turned and the cartilages uniting the ribs to the breastbone are cut; the cut is continued through the belly wall, taking care not to cut the rumen or intestines.

(viii) The ribs are separated from the belly wall and from each other and pulled back until their joints break.

(ix) A knife is used carefully to remove the abdominal organs by cutting the membranes holding them in place; care should be taken to avoid cutting into the stomach and the large veins.

Fig 49 - EXPOSING THE BRAIN OF RUMINANTS AND CARNIVORES IN CASES OF SUSPECTED RABIES.


cut lines
frontal view
side view
cutting lines for separating the skull in two halves
cut lines for exposing both halves of the brain in dogs

(See section 120)

(x) The organs are removed in the following order and washed carefully in water: the spleen (which is attached to the stomach or rumen in ruminants); left kidney (which is attached to the backbone); stomach and intestines, liver, right kidney, heart, lungs.

(xi) The mesenteric lymph nodes are in the thin membrane which holds the intestines from the backbone.

(xii) The largest lymph nodes are a handsbreadth in front of the shoulder and just above and in front of the stifle joint respectively.

(xiii) To expose the brain of a ruminant the head is first detached by cutting through the joint at the base of the skull. The top of the head is skinned and the bone just inside the horn roots broken with a chisel or machette. The cut or break is continued from just behind the eye sockets to the opening for the spinal cord. A transverse cut is made behind the eyes and the piece of bone thus separated, prised off.

Burning a Carcase
(Section 121)

(i) Two trenches should be dug in the form of a cross each being 2 m long and 40 cm wide, the depth increasing from a few centimetres at the ends to 40 cm deep in the middle.

(ii) The earth is piled into four heaps in the angles and two iron bars placed on them so that they lie across one of the trenches.

(iii) Strong wooden posts are placed across the bars on which a fire of straw and wood, well soaked in waste oil, is made.

(iv) The carcase is then placed on the heap of fuel and can also be sprayed with waste oil or kerosene.

(v) Wood can be placed on the carcase until it is completely burnt.

CHAPTER 15

RESTRAINT OF LIVESTOCK, MINOR OPERATIONS AND CARE OF LIVESTOCK UNDER TREATMENT

Restraint of Livestock

(Section 122)

Use of Crush

The A.H.A. will often have to handle cattle for injecting them, taking blood samples, giving medicine and examining ear tags.

This kind of work can best be done in a crush, a long narrow corridor along which animals can only move in single file. .Animals can easily be restrained and handled in a bale in the crush made by inserting poles in front or at the back of the animal or confining its head in a headgate (see Fig. 50).

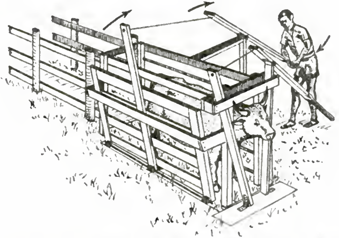
A crush and bale are often incorporated into the race of a dipping tank or spray. The sides of the crush are generally made of poles and timber or piping. Wood is better as the animals accept it better than piping. In some countries and areas where other material is scarce, solid walls are used which makes blood sampling very difficult.

The width of a crush is generally 60-70 cm It must not be so wide that an animal can turn round in it.

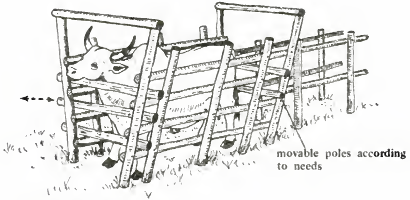
In many crushes a movable gate can be inserted to divert certain animals into a pen separate from the main herd.

Fig 50 - CATTLE HANDLING RACES, USED FOR BRANDING, DEHORNING VACCINATIONS AND TREATING WOUNDS ETC.

(See section 122)



Race with a 'crush' which can also hold the head of the animal


movable poles according to needs

A simple race made with posts.

Throwing Cattle

Often adult cattle have to be thrown and held down to enable operations to be done on them, wounds dressed or overgrown hooves trimmed.

Throwing an animal should be undertaken as follows:

(i) Straw, leaves or sand should be put down to form a bed if the ground is hard.

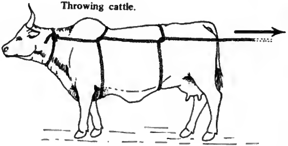
(ii) The animal should first be tied by the head in a yard, paddock or large box stall. The lead rope should be tied in such a way that it can quickly be released, e.g. when the animal goes down.

(iii) A 9-12 m rope is taken and one end tied round the base of the horns and then passed three times around the body as shown in Figure 51; the loops in half hitches lying near the backbone. If the animal has no horns the first circle with one end of the rope must be fastened with a non-slip knot.

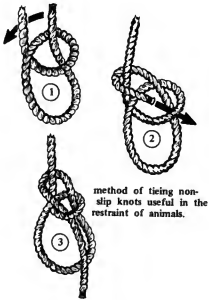
(iv) The other free end of the rope is then steadily pulled and the animal will go down slowly.

(v) A simpler method of throwing less valuable animals is shown in Figure 51.

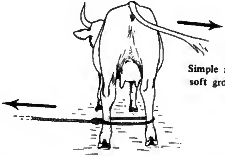
If involved in throwing animals the A.H.A. must be very careful to avoid getting entangled in the rope.



Throwing cattle.



method of tieing non-slip knots useful in the restraint of animals.



Simple method of throwing light animals on soft ground.

Fig 51 - RESTRAINT OF CATTLE. (See section 122)

Fig 52 - RESTRAINT OF BULLS.

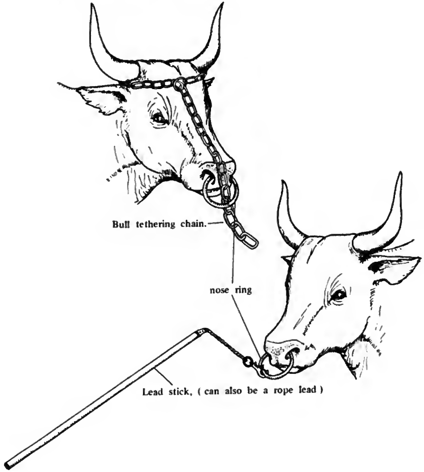
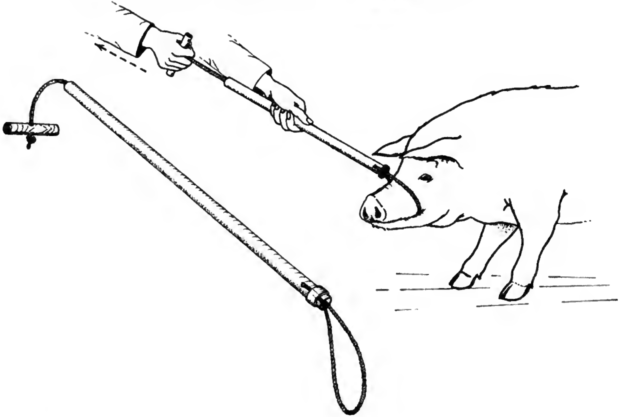

Bull tethering chain.
nose ring
Lead stick, (can also be a rope lead)

Fig 53 - HANDLING LARGE PIGS. (See section 122)



If an animal is tied by the head and is docile, a useful measure of control is obtained by one operator standing near the shoulder of the animal facing towards the animal's tail head and lifting up the forefoot, a second operator carrying out whatever procedure is necessary.

In pigs the animal is restrained by passing a loop over the upper jaw and then a second loop over the whole snout to keep the jaws closed (see Fig. 53.)

When handling cattle in a crush, good control can be secured by holding the head with fingers in the nostrils or in the mouth, although this method is tiring. The use, therefore, of "nose tongs", a simple metal clamp, the curved ends of which fit into the nostrils giving easy control of the animal, is a very useful piece of equipment (see Fig. 45.)

Throwing Sheep and Goats

These species can be thrown by leaning over the animals back from the left side and gripping the two legs nearest the operator. The animal can then be lifted off the ground and laid on its side. If the operator kneels on its neck and holds the lower rear leg it cannot rise.

Giving Medicines

(Section 123)

Oral Administration

This means giving medicine by the mouth. It can be done by giving the medicine in the feed.

The animal or animals are fasted for a few hours, the medicine being given in about half the normal quantity of feed. Animals in a group should be watched to ensure that individuals are not driven away by the others.

Powders, small quantities of liquids and crushed tablets can be given this way. The method is very suitable for giving feed elements such as minerals and vitamins or medicines such as those for worm infections.

In cattle, capsules, boluses and pills may be placed at the back of the throat by hand but usually these are given by a "balling gun."

A balling gun is a simple hollow metal rod with a cup in the head to hold the bolus or pill and a plunger which pushes the bolus or pill out of the gun.

Giving medicine with a balling gun is carried out as follows:

(i) Bolus or capsule is placed in head of gun.

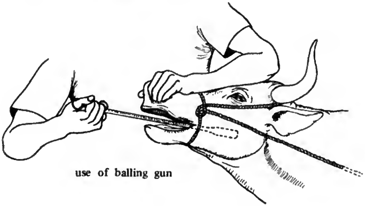
(ii) Animal is restrained - a pair of nose tongs will probably be sufficient.

(iii) The bolus or capsule is placed by the action of the gun's plunger behind the base of the tongue in the animal's mouth.

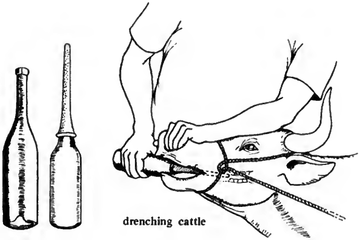
(iv) The animal will probably swallow the bolus or pill at once but if it chokes or coughs the animal's head should be freed so it can lower it to cough out the bolus or pill. If this is not done the bolus or pill may enter the windpipe and not the gullet.

Fig 54 - DOSING CATTLE. (See section 123)

balling gun



use of balling gun



drenching cattle

The balling gun can be used for cattle, sheep, goats and pigs. In pigs it is more difficult to use than in other animals because of the shape of the pig's throat which forms a kind of pocket in which the bolus or pill can get stuck.

Drenching Livestock

If animals will not take medicine with their feed it can be poured into the animal's mouth with a bottle or down a tube directly into the animal's stomach. This is called drenching.

Drenching must be very carefully performed otherwise some of the fluid may go down into the animal's lungs and cause pneumonia and possibly death.

Drenching with a bottle should be carried out as follows:

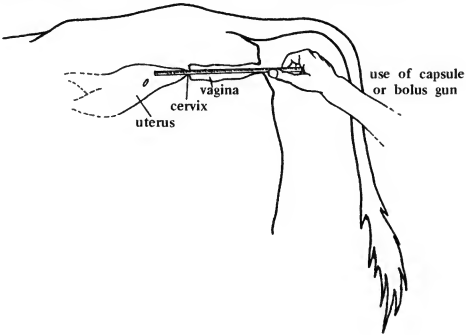
(i) Restrain animal with nose tongs and a rope in its mouth which keeps the animal chewing and swallowing. Animals should not be drenched if suffering from any disease of the lungs.

(ii) A bottle issued by the Veterinarian or approved by him fitted with a short rubber hose is used. A beer or wine bottle is suitable.

(iii) The correct dose of medicine must be used - too much may be harmful.

(iv) The animal's mouth is raised in line with the neck. It must not be too high.

Fig 55 - MEDICINE BEING GIVEN BY CAPSULE OR BOLUS FOR TREATMENT OF COW'S UTERUS. (See section 123)



(v) The open end of the tube of the bottle is put into the side of the mouth with the end of the tube or bottle on the middle of the tongue or in the cheek beside the teeth. Great care must be taken to ensure the bottle neck does not get between the teeth and get broken.

(vi) Only a small quantity should be given at a time - 57g for cattle and other large animals and less for sheep and goats. Pour medicine slowly

(vii) Allow a minute or so for the animal to swallow the dose and to breathe and then give the next dose.

(viii) If animal coughs allow it to lower its head. The tongue should not be interfered with in any way.

(ix) If more than half a litre of medicine has to be given, 10-15 minutes should be allowed between doses.

(x) Sheep are more difficult to drench than cattle. They should be standing firmly on the ground and their noses should not be raised higher than their eyes.

(xi) Medicine for sheep is often given with a syringe or from a piece of tubing with a metal tube at the end, the other end being attached to a funnel. The metal tube is placed in the sheep's gullet and the medicine poured into the funnel.

Treatment of Wounds
(Section 124)

Animals are frequently injured from horn pokes, cuts from wire or sharp objects and bruising.

Such injuries are usually caused by objects which are dirty so that the cut or wound may be infected with bacteria.

The first thing in treating a wound is therefore to clean it. This can be done by mixing 2 teaspoonfuls (5 ml) of salt in about half a litre of luke-warm water and thoroughly cleaning the wound with the solution, picking out any thorns, dirt or foreign objects.

It is essential in some areas and desirable in all to inspect the wound every day to prevent flies laying eggs around the wound and eggs developing into larvae and maggots (screw worms). This can be prevented by using a fly repellent, screw worm remedy or tick-grease or stockholm tar around the edge of the wound.

A dusting powder containing iodoform, charcoal and sulphanilamide powders (in equal parts) keeps away flies and promotes healing in areas where "screw worm" is not a problem.

If wounds are very severe involving joints, large blood vessels or tendons, it may be necessary to slaughter the animal.

In cases where animals have been bitten by wild animals or dogs, the A.H.A. must remember that rabies may develop in the animal as a result of the bite.

Marking Animals
(Section 125)

Branding

The best means of marking cattle as, for example, when marking animals in large numbers, e.g. after immunization against rinderpest, is by branding.

In some countries with official disease eradication programmes, as for tuberculosis and brucellosis, branding is used to mark the tested animals. Cattle are often branded to show the ownership of the animal and to prevent animals being stolen (see Fig. 56).

Branding can be done by the use of (a) a hot iron, (b) a cold iron dipped in a branding fluid, but this method is not very satisfactory and (c) with an iron cooled in liquid nitrogen when this is available.

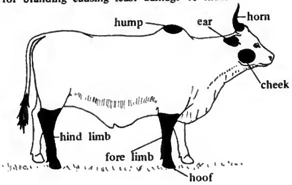
Branding is best applied with animals in a crush or race.

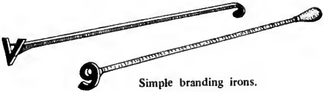
The irons, with handles of about 80 cm, are best heated in a fire made with wood to the point when it is a cherry red colour. At this colour the iron need be applied for a short period only (a count of three). It is then not so painful and the mark will be clear.

The animal must be dry when branded. Brand marks should be kept as small as possible and never exceeding 10 cm.

Branding should always be done on the animals cheek or on either of the hind limbs below the level of the stifle or on either forelimb below the level of the elbow (see Fig. 56).

Sites for branding causing least damage to hide.




Simple branding irons.

Ear clipping of pigs.

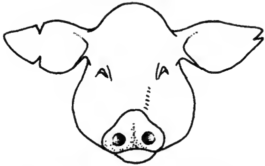


Fig 56 - MARKING ANIMALS. (See section 125)

In these places branding will not seriously damage or reduce the value of the hide. An animal should never be branded on the hindquarters. This is the most valuable part of a hide and brand marks on it make the hide useless.

Ear Clipping

This is a very useful method of marking stock. It is not painful and if each year's calves (or pigs) are clipped (notched) in a different place on the ear, the animal's age can be seen at a glance (see Fig. 56).

Tattooing

This is a method of marking cattle, generally used for valuable purebred cattle. Tattooing is done with a special instrument that places numbers or letters in and under the skin of the ear and colours these with indelible ink.

Ear Tagging

This is another method also generally used for purebred cattle. In this method metal tags or buttons are fixed in the ear and these carry numbers or letters.

Dehorning Calves
(Section 126)

Introduction

Cattle without horns are usually quiet and docile, do not fight other cattle and do not injure the hides of other cattle.

Cattle should always be dehorned when they are calves at about 5-8 days old before the horn buttons become too hard.

Use of Caustic Soda

Dehorning adult cattle requires the technical skill of the Veterinarian. However, the A.H.A. may be instructed to dehorn calves and this should be done in the following way:

(i) The calf should be 5-8 days old.

(ii) The hair around the horn button should be clipped so that the tip of the horn button is easily seen.

(iii) If caustic soda is being used, a ring of vaseline is placed round the button to stop the caustic soda running into the calf's eyes or down its face.

(iv) The stick of caustic soda is held in the tin-foil. This must be done otherwise the A.H.A. will have his fingers burnt.

(v) The caustic stick is moistened at its exposed end and each horn button rubbed. The buttons are allowed to dry and the procedure repeated.

(vi) If the horn button bleeds, rubbing with the stick should be stopped and vinegar, if available, applied to stop the burning effect of the caustic soda.

(vii) Dehorning should be done in the evening after the calf has suckled from the cow. It should then be kept by itself for 12 hours to prevent it putting caustic soda on the cow's udder.

(viii) Dehorning sticks will be issued by the Veterinarian - they are also generally obtainable from the pharmacy. They should be kept in an air-tight tin otherwise they will disintegrate.

Use of Hot Iron

Horn buttons can also be removed by a hot iron. The end of the iron is round and hollow so that its sides go down round the button.

The hot iron is applied for a few seconds, the horn button being removed by the heat and a slight gouging motion of the iron.

Ringing
(Section 127)

In the case of a bull, ringing makes him more tractable, safer and easier to lead. In the pig it prevents him from rooting.

A bull is ringed when he is about one year old or earlier if he is vicious.

Rings made for ringing cattle are hinged and have a screw for fastening the two loose ends when they come together. Rings usually have one end pointed and are put on by hand or with special pliers, but if it is necessary to make a hole this can be done with a sheep size trocar and cannula used for relieving bloat, or a strong narrow pointed knife can also be used.

In using the trocar and cannula the instrument is pushed through the thinnest part of the dividing partition between the two nostrils this being about 3 cm from the muzzle.

The trocar is withdrawn leaving the cannula in the nose.

One end of the ring is slipped into the cannula which is then carefully drawn back through the opening in the cartilage, the ring taking its place.

After-treatment consists in keeping the wound free from dirt and pus until healing takes place.

In pigs a stiff wire is used as a ring it being inserted by means of pincers.

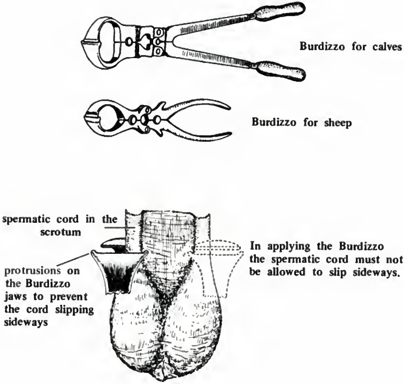
Castration
(Section 128)

The A.H.A. may need to castrate calves and this should be done when they are 1-6 months old - the younger the better.

Castration is best done in the field by the use of the Burdizzo which crushes the spermatic cord without cutting or wounding the scrotum skin.

Fig 57 - USE OF THE BURDIZZO FOR CASTRATION.

(See section 128)


Burdizzo for calves
Burdizzo for sheep
spermatic cord in the scrotum
protrusions on the Burdizzo jaws to prevent the cord slipping sideways
In applying the Burdizzo the spermatic cord must not be allowed to slip sideways.

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The crushing of the cords stops blood going to the testicles which at once stop producing seminal fluid and wither away.

For older animals to be castrated by the use of a knife the Veterinarian will need to carry out the operation.

When the Burdizzo pincers are used this method can be applied at any time of the year and under all weather conditions since it makes no external cut or wound. The procedure should be carried out as follows:

(i) The Burdizzo pincers castrate by crushing the cord inside the scrotum each spermatic cord being crushed one at a time.

(ii) The cord should be held in place as the pincer jaws close so that the cord does not slip sideways thus avoiding being crushed.

(iii) Some modern Burdizzo's have small protrusions on the jaws of the instrument which prevent the cords slipping to one side.

(iv) No external bleeding should occur and no after-attention is needed with Burdizzo.

Sheep and goats can also be castrated by the Burdizzo. There are different sizes of Burdizzo. The larger sizes can be used for adult bulls and camels.

Pigs are best castrated with a sharp knife, the young pig being held by an assistant who grasps the hind legs in his hands and holds the pig's body, with the head downwards, between his legs. Before attempting this type of castration in which a sharp knife is used the A.H.A. should be given the authority of the Veterinarian to use the method and should have been instructed in its use.

Lambs tails can also be "docked" by the use of the small size of Burdizzo. The pincer is applied between the first and second bone, the tail being cut off inside the Burdizzo (which prevents bleeding) and the wound dressed with a disinfectant.

Before using the Burdizzo the A.H.A. should have the instrument well demonstrated and explained to him.

Trimming Feet
(Section 129)

The feet of cattle kept for intensive forms of production under artificial conditions should be carefully and regularly examined after the animals reach 9 months of age.

Under such conditions untrimmed feet may lead to badly developed legs, the animal may not graze well and thus goes down in condition.

Trimming is best done with the animal standing on a hard level floor, the feet being trimmed with the animal standing. If the animal is too wild it should be thrown.

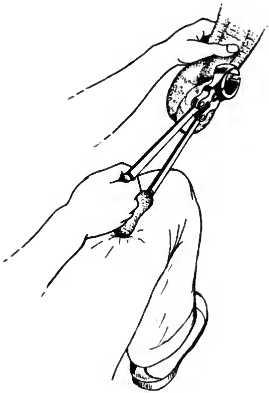


Fig 58 - APPLICATION OF THE BURDIZZO WITH THE HELP OF THE KNEE IN CASE OF LARGER ANIMALS. (See section 128)

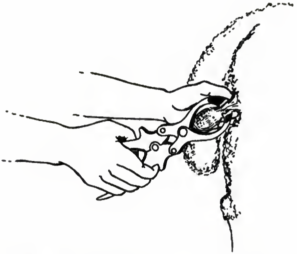


Fig 59 - USE OF THE BURDIZZO FOR CASTRATING LAMBS. (See section 128)

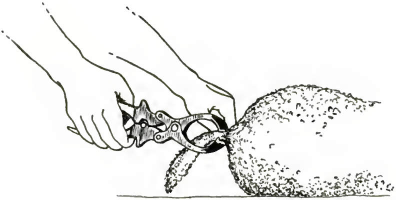
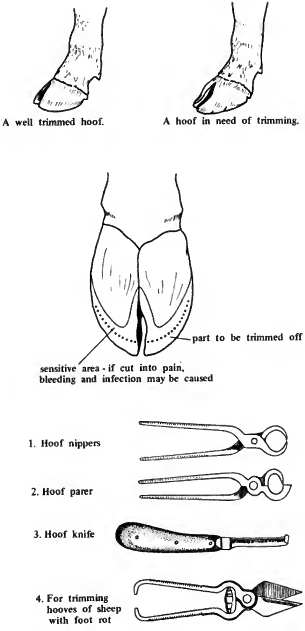


Fig 60 - 'DOCKING' A LAMB'S TAIL WITH A BURDIZZO.

(See section 128)

Fig 61 - TRIMMING HOOVES. (See section 129)


A well trimmed hoof.
A hoof in need of trimming.

part to be trimmed off
sensitive area - if cut into pain, bleeding and infection may be caused
1. Hoof nippers
2. Hoof parer
3. Hoof knife
4. For trimming hooves of sheep with foot rot

Trimming consists of cutting off long "toes" (with hoof "snippers") and paring the bottom surface of the claws and the forward growth of the "toes" (with a hoof knife and rasp).

Great care must be taken in trimming hooves. If too much of the hoof is trimmed off the sensitive part of the foot may be cut into and pain, bleeding and infection may result.

Care of Livestock under Treatment
(Section 130)

An increasing number of diseases can now be successfully treated with modern drugs. As new specific treatments become available the need to care for treated animals (i.e. the nursing of animals) also becomes increasingly important.

To the stock-owner, particularly owners of small herds or owners of valuable animals, successful treatment and the rapid recovery of the animal is likely to enhance greatly the prestige of the A.H.A. responsible in his district.

In ensuring good nursing care of the treated animal the A.H.A. should keep in mind the following points:

(i) The animal should be kept in quiet surroundings and provided with an ample supply of clean water and, when its appetite returns, high quality feed according to its species and age.

(ii) Animals, especially those weak and unable to stand for long periods, should be given plenty of soft bedding such as straw and, if unable to rise, should be moved 3 or 4 times a day to prevent pressure (bed) sores developing.

(iii) In tropical countries and in hot sunny weather ample shade should be provided. Even a simple wooden frame covered with palm fronds or other leaves can be effective. In wet weather a temporary shelter should be provided for the animal.

(iv) In recovering from diseases such as anaplasmosis, babesiosis and trypanosomiasis in which anaemia is associated with the disease, high quality feed together with mineral supplements containing iron and traces of cobalt should be given.

PART 6

SLAUGHTER OF ANIMALS AND PREPARATION OF HIDES AND SKINS FOR MARKET

CHAPTER 16

SLAUGHTER OF ANIMALS

General
(Section 131)

The A.H.A. may be asked to kill an animal. The most effective and humane way to destroy an animal is by a well directed bullet.

The A.H.A. may be issued with and taught to use a humane killer but this is unlikely. This means he must have a gun and be licensed and authorized to use it. This also may not be possible.

The only alternative open to the A.H.A. is to request the Veterinarian or a Police Officer to kill the animal.

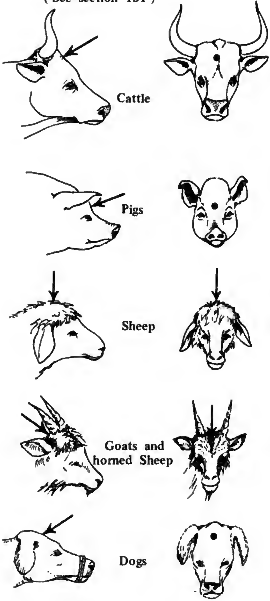
In cattle the point to aim at is at the intersection of two imaginary lines when drawn between the opposite eyes and horns (see Fig. 62).

If the animal can be used for meat the animal's throat should be cut immediately after the use of the gun or humane killer to facilitate bleeding.

Hides are a valuable part of the carcase of animals. The best hides can only be obtained from animals killed in good surroundings and that have been well treated before slaughter.

Fig 62 - USE OF CAPTIVE BOLT PISTOL IN KILLING ANIMALS.

(See section 131)



Whenever possible animals should be killed on a cement or stone floor and where a hoist is available.

A hoist consists of a 150 cm horizontal pole resting on two 250 cm upright poles (see Fig. 63).

In order to have the animals in the best possible condition for slaughter the following points should be noted:

(i) the animal should be well rested and kept in a pen and separate from the rest of the herd the evening before it is killed.

(ii) Animals should not have feed the evening before being killed but they should be allowed to drink.

(iii) Animals should be slaughtered early in the morning.

(iv) If a slaughter-house is not available a sloping, clean site should be selected on which a groove 15 cm deep and over 3 m long should be dug to act as a blood drain and to steady the carcase during the flaying.

If no gun or humane killer is available the animal should be gently thrown. A knife, pointed and sharp 45-50 cm long should be used to cut the throat of the animal in one, long, deep, rapid cut as near the head as possible.

The dewlap should be cut straight down. The carcase should then be hoisted up so that bleeding is complete, the blood being collected for feeding poultry etc.

After bleeding the carcase can be lowered to the ground, placed on the groove in the ground and the cuts made for taking off the hide (Section 140). The carcase can again be hoisted as this facilitates the final stages of taking off the hide.

CHAPTER 17

PREPARATION OF HIDES AND SKINS FOR MARKET

Introduction
(Section 132)

One of the most valuable exports of many developing countries is hides and skins. Hides are, therefore, a valuable source of income to the livestock owner. If properly cured, the value of the hide is often equal to one quarter the value of the whole animal.

Unfortunately, the livestock owner rarely obtains the full value of the hide or skin that he might, because usually his hide or skin is badly flayed, badly cured, badly damaged by horn pokes, brand marks and by insects, and the methods employed in marketing the hide or skin are unsatisfactory.

It is important to remember that most hides and skins eventually become leather of one kind or another. To become leather, hides and skins must be tanned, and it is after tanning that any damage done to a hide either during the life of the animal, or after it is dead, will be revealed most clearly.

What the tanner wants by way of a good hide or skin must, therefore, be the producers' main consideration.

Damages Affecting the Value of Hides and Skins

Damages to Hide in the Live Animal
(Section 133)

Branding is one of the worst causes of hide damage. The worst branding is the branding for ornamentation often seen on the most valuable parts of the hide.

The places on the hide where branding should be done are the cheeks, below the point of the shoulder on the forelegs, and below the point of the stifle on the hind legs, and the ears.

Scratches may be caused by wire, horns or thorns, and may often be unavoidable. Horn rakes can be eliminated by the dehorning of calves.

Yoke callouses in draught animals may also sometimes injure the hide while wounds very often leave scars which result in blemishes to the finished leather.

Whip lash marks are often found on hides from working oxen; they also cause permanent damage to the hide.

Tick bites leave small but distinct blemishes which appear either as small holes in the leather, or as small scars. Such hides are described as "ticked" hides and are of inferior quality. Only regular dipping or spraying to control the ticks will keep the hide free of this damage.

The most important skin diseases affecting the hide directly are ring worm, mange, streptothricosis, lumpy skin disease and cow pox (see Sections 76, 70, 39, 45 and 51). These diseases cause damage to the finished leather in various ways including circular depressed patches, pin-point depressions and scars and putrefied areas. Dipping and spraying are the main control measures employed for these.

Other diseases such as rinderpest and East Coast fever in which high temperatures are a feature, will also affect the hide. If high temperatures do not extend beyond 3-4 days, changes in the hide will not, however, be noticeable.

Nutritional diseases and conditions, including the presence of worms, and malnutrition, etc., also result in hides of inferior quality.

A suspected anthrax carcase should not be flayed.

"Fallen" hides, or hides taken off dead animals, if quickly and properly treated will be of some value even if not first grade. If an animal is sick and is obviously going to die, it should be killed, in which case its hide will be of more value than if left on the animal until it dies.

Damages during Killing and Flaying
(Section 134)

Bruising occurs from blows or bad throwing on the killing floor while bad bleeding of an animal will lead to putrefaction in the hides.

Dragging a carcase along the ground will also obviously injure the hide since blood, manure, stomach contents, dirt, etc., on the hide, will all hasten deterioration.

Sheep skins, if badly pulled off a carcase, will be liable to damage from "strain" in which the fibres of the skin are broken.

Bad shape from distortion and badly placed cuts when flaying are not corrected by the tanners.

"Scores" are cuts made into the hides which do not penetrate completely. This damage is generally done during flaying and when pointed knives are used in fleshing. Gouge marks are caused during the removal of meat, and will be avoided if proper knives or scrapers are used, and if fleshing tables are smooth.

Cuts cause heavy losses each year to hides and skins, and are generally due to delay in flaying, the flaying of a cold carcase, the use of pointed knives, lack of skill, and carelessness and unsuitable surroundings in which flaying is done.

Tanning enlarges cuts in the finished leather.

Damage after Flaying
(Section 135)

"Hairslip"

"Hairslip" is a common type of damage and is due to delay between flaying and drying, leaving uncured hides folded for more than a few hours, not having the hide or skin free of objects during curing and exposing the dry hide to wetness. To prevent "hairslip" the following measures should be taken:

(i) hides must be dried immediately after flaying;

(ii) uncured hides should not be folded or left in bundles and if carried should be transported on a pole;

(iii) hides should not touch any object while drying;

(iv) dry hides must always be properly protected.

Putrefaction

Putrefaction will occur in hides as a further step in deterioration if "hairslip" has not been checked.

The worst cause of putrefaction is the method of "ground drying", still often practised by many stockowners. This method entails the drying of the hides in the sun after pegging them to the ground.

Ground-dried hides are bad because

(a) where the hide touches the ground, putrefaction sets in.;

(b) although hard on the outside, they are often soft inside;

(c) they are often excessively dry, being as hard as boards. Cracks then develop during folding;

(d) they often split along the various layers of the hide;

(e) due to over-heating, fat on the hide melts and spreads into the hide;

(f) rain collects in puddles on the hide, and causes unevenness in texture.

The best method of curing hides and skins is the suspension method which will be described; even with this method, however, certain damage can be done to the hide.

Damage in Suspension Drying
(Section 136)

When the hide is being stretched, care must be taken that all the supporting ropes and thongs (ropes made of hide or skin) are uniformly tight - otherwise distortion of the hide takes place.

Hides must not be over-stretched, otherwise they will become thin and "spready".

Vermin are often the cause of damage to hides, pieces being bitten off, etc. The drying equipment or area should be surrounded with wire or a thorn bush. Frames should be hung from trees.

Damage after Drying
(Section 137)

Beetles are the cause of considerable losses each year in hides and skins. Beetles hide in the cracks and crevices of wood, so that hide stores should be built of stone or brick, with a smooth plaster finish. Insecticides should also be used whenever hides have to be stored for more than ten days.

White ants may attack hides and skins but this can be prevented by storing them on wooden slatted platforms not less than 15 cm above the concrete floor level preferably suspended from the roof. They should not touch the walls at any point.

Rats and mice which may also cause damage can be kept down by traps, poison and cats.

Cement floors, on which hides and skins may be stretched, cause staining. Stacking on platforms will avoid this.

The wetting of hides after they have been dried may cause damage. To avoid this hides should be immediately opened out and dried again.

Damage during Roping and Transport
(Section 138)

If hides are too loose baled, or too tightly baled, or if wire should be used in place of rope or binding iron and sacking, damage will result.

Wetting of hides and skins and the rubbing of bundles together while in transit, will both cause damage.

Fraudulent Practices
(Section 139)

Some unscrupulous persons sometimes soak ground-dried hides and stretch them on frames, selling them as suspension dried. Severe penalties may be imposed under the law for this practice.

Weight may sometimes be added to hides by smearing their flesh side with mud, etc., or soaking them a day or two before sale.

Scores and gouge marks are sometimes covered with clay, while parasitic and pox marks may be painted over.

Used hides, which are of practically no value, may be offered for sale.

Fig 63 - HOISTING A CARCASE TO FACILITATE REMOVAL OF HIDE AND PREVENTING ITS SOILING FROM BLOOD AND FAECES ETC. (See section 131)

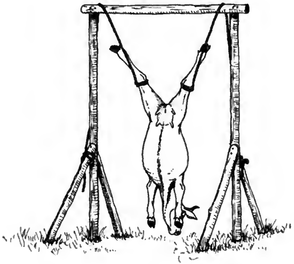
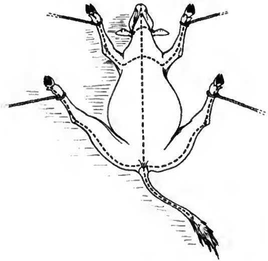


Fig 64 - THE CORRECT RIPPING LINES TO ENSURE A SQUARE SHAPED HIDE WHICH BRINGS THE HIGHEST PRICE. (See section 140)



Flaying
(Section 140)

Cattle

The value of the hide depends to a very great extent on the flaying. To flay properly the following points must be observed:

(i) a proper and sharp knife should be used;

(ii) the knife should be held properly;

(iii) the correct ripping cuts should be made;

(iv) the carcase should be flayed immediately after slaughter;

(v) the carcase should be kept steady;

(vi) the hide should be kept free of blood and manure;

(vii) cutting, gouging or scoring should be avoided;

(viii) the hide or skin should be pulled or beaten off whenever possible;

(xi) long cuts with the knife should be made, not short ones.

A proper flaying knife is one with a curved blade more than 15 cm long with a rounded, blunt tip (see Fig. 65).

The knife must be held firmly in the hand with the sharp edge towards the carcase (see Fig. 65).

In the ripping of the carcase, the following cuts must be used (see Fig. 64):

(i) one long, straight incision on the centre belly line, from neck to anus;

(ii) two incisions around the hocks;

(iii) two incisions on the forelegs around the knees;

(iv) two straight and downward cuts on the inside of the forelegs from the knees to the breast bone;

(v) two similar cuts on the back of the hindlegs starting from the hocks and finishing at the anus.

Flaying then consists of pulling the hide away with one hand and cutting with the other.

When the bellies are sufficiently flayed, the carcase should be hoisted and the remaining hide pulled off.

The tail is flayed by one long incision on the inside to remove the tail bones and then the hide is pulled down.

The fat around the hump must be carefully cut away.

Evisceration of the carcase should not take place until the hide is off.

The custom of cutting up the meat and putting it on the hide should not be followed.

In flaying, the knife should be used as little as possible. Sheep skins need only a very few cuts.

In some places, wooden or brass mallets are used to beat the hide or skin off the carcase.

The mask or face skin should always be saved and taken off with the hide. Ears must be cut off.

Sheep and Goats

The pre-slaughter care of sheep and goats and their killing is very much the same as for cattle.

The ripping cuts for sheep and goats are:

(i) one long, straight incision from the jaw to the anus, on the centre of the belly;

(ii) four circular cuts around the shanks;

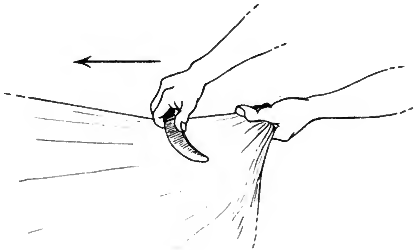
(iii) two cuts on the inside of the forelegs, from the shank to the breastbone;

(iv) two cuts on the back of the hindlegs from shank to anus.

It is better as a rule not to make all the ripping cuts, but to pull the skin off unopened. Such skins are called "cased". the skin is peeled off the carcase (which is hung up) like a glove, the knife being used as little as possible.

Cased skins must always be opened up for drying, washing, etc.

Fig 65 - FLESHING A HIDE AFTER FLAYING. THE TYPE OF KNIFE AND THE ANGLE IN WHICH IT IS TO BE HELD SHOULD BE NOTED. (See section 141)



Washing and Fleshing
(Section 141)

Hides and skins should always be well washed immediately after flaying. They should not be washed in a container, but water run over them.

After washing, all loose tissue and meat left on during flaying should be removed.

This must be done carefully, the following points being noted:

(i) fleshing must be done immediately after flaying and washing;

(ii) the hide should be put on a perfectly smooth table;

(iii) if a table is not available a smooth log may be used, the hide may be hung over a horizontal pole, or laced into a frame;

(iv) a very sharp knife or scraper should be used;

(v) a little meat left on will not matter, but cuts made trying to get it off, do matter;

(vi) to remove hump flesh, the hump should be filled with grass, etc., so that the flesh stands out on the hump.

Trimming and Lacing
(Section 142)

So as to suspend a hide or skin, holes have to be cut all round it in which strings or reims (ropes made from hide or skin) can be inserted.

A large hide may require up to 34 holes. Either a knife may be used or a No.12 punch. The holes should be about 2-3 cm from the edge and symmetrically placed.

To lace the hide into a frame, the hide is first suspended by two ropes from the top pole, then tied down to the bottom one by two more ropes attached to the tail piece.

In this way a straight central line will show whether the hides have been symmetrically hung.

Lacing should be done by two workers, one on each side, and each ensuring that their ropes have the same tension. The ropes should not be too tight.

In hide sheds, hides are hung flesh side towards each other so that one stick will stretch two humps.

When lacing on a wire rack, the hide is placed over the top wire exactly along the backbone line, and the tail and shoulder of the head (if they are dried together), are stretched first.

The laces are stretched to the pegs in the same way as is done on a frame.

If the wire rack is to be used without pegs, small sticks or branches must be used to straighten out any folds or wrinkles, this being done after the head and tail parts have been attached to the rack (see Fig. 67).

In drying sheep or goat skins pegs are not used, only sticks for stretching the folds.

Drying and Trimming

(Section 143)

Drying depends on the thickness of the hide and the moisture in the air. It cannot be hurried, and may take up to 14 days. The hide must be taken down when it is properly cured and not too dry.

This section should be read in conjunction with Sections 152 to 155. The hide, which has already been trimmed after flaying is once more trimmed after drying so as to give it as good a shape as possible.

Folding

(Section 144)

Folds should be reduced to the minimum. Hides should always be folded with the hair inside, so as:

(i) to protect the grain which is the most valuable part of the hide;

(ii) to avoid cracking the grain;

(iii) to reduce contamination, by dust and dirt and excess moisture during rain or in a humid climate, to a minimum.

Hides should be folded when they have been properly cured, but not when they are too dry.

Hides dried out of doors on racks or frames should be folded early in the morning, since the hides will contain more moisture then than later on. This minimizes cracks.

Only one lengthwise fold should be made. When the hide reaches the exporter, it is folded for baling, two additional folds lengthwise being made, which take in about 23 cm of the bellies. After these folds, the whole is folded crosswise on the shoulder line.

Storage
(Section 145)

When hides are not to be despatched for sale within a few days, they should be treated with an insecticide.

Insecticides can be of two kinds, liquids such as solutions of arsenic in water, or powders such as D.D.T., gammexane, pyrethrum, derris or naphthalene, etc.

Solutions of arsenic for this purpose are similar to those used in dipping tanks, and if no other means of treating them are available, the hides may be dipped in the dipping tank.

Although arsenication is generally used for dry hides, it is better to use it for the uncured hides.

Great care must be taken in the use of arsenic, since it is a deadly poison and must always be kept under lock and key.

Other commercial dips are preferable and should be diluted in accordance with the instructions for preparing normal strength dip solution (often 1 : 300).

Sodium silicofluoride may be used as a spray in the proportion of 0.5 kg to 10 litres of water, if it is available.

If powders such as gammexane are used, they should be mixed with an inert powder such as diatomite using a machine to mix them. If pyrethrum is grown locally, it can be dried and ground into a powder, and dusted over hides and floors, etc.

During the wet season, hides stored for a long time should be taken out into the sun occasionally, to prevent the formation of moulds, which are not affected by insecticidal dips or powders.

Grading of Hides
(Section 146)

Grading means judging the quality of hides on their appearance, and assessing their value according to their usefulness to the tanner. A.H.As may be in charge of hide sheds, and in any case, should know the grades so that they can advise the livestock owners when they are preparing their hides and skins to sell.

In small collecting centres grading is rarely properly done, and stockowners generally lose badly on their sale or barter.

The system of buying a number of hides at one time, irrespective of their quality, weight or origin is the main obstacle in many areas to providing an incentive to the stockowner to induce him to devote more trouble and attention to the preparation of his hides and skins.

Graders employed by the various tannery firms naturally want to come out on the right side financially and thus tend to undergrade to avoid making financial losses.

Producers must, therefore, gain a knowledge of grading, if they are to protect themselves and the A.H.A. can be very helpful to them in this.

It must be kept in mind that in some areas, legislation makes it illegal to buy in numbers and illegal to barter hides and skins for groceries. They must be bought by weight and grade, and every store must exhibit a board on which the prices paid per kilogramm of hide are clearly set forth.

Grading is done by a thorough inspection of the hide and skin in a good light.

To guide the hide owner a grading form will be found as Appendix 14 in which is set forth the various defects to be looked for.

Although first, second, third and fourth grade as described below are accepted as standards by the trade, it must be remembered that the final test is in the tanning. Grading, therefore, consists largely of the grader's opinion as to the value of the leather which will be made out of the hide or skin he is grading. The worse the hide, the worse the leather and the worse the grade and thus the lower the price.

The Grades
(Section 147)

1st Grade

The whole of a first grade hide should be convertible to a first grade leather.

Such a hide must, therefore, be derived from a healthy animal, properly slaughtered, flayed, dried and stored, free of all blemishes and of perfect shape.

2nd Grade

Such a hide must have no blemishes whatsoever on the bend (back) but less valuable parts like the bellies, neck, etc., may show one of the following blemishes:

- a small brand on one side;
- several gouge marks or two holes in the bellies;
- small putrefaction areas or hairslip;
- small pox marks;
- small insect damage on the edges only.

All 1st grade hides badly shaped are considered 2nd grade.

3rd Grade

A 3rd grade hide must have at least half of its surface in perfect condition. All 2nd grade hides which are badly shaped or show two of the above enumerated blemishes simultaneously, are considered 3rd grade.

Putrefaction must not affect the bend, but slight smoke or water damage is allowed.

4th Grade

One third of the whole hide surface must be in good condition.

All 3rd grade hides which are extensively smoked or water damaged, fall into the 4th grade.

Rejects

Where more than two-thirds of the hide shows defects, these are unsuitable for the tanner, and are rejected.

These hides or skins may not be sold or bought, but may be traded as glue stock after being cut into halves.

Into this grade fall mostly hides damaged by putrefaction and insects.

Grading of Sheep and Goats' Skins
(Section 148)

The same principles apply in grading skins as for cattle hides.

Skins are much thinner than hides, so that marks, putrefaction or insect damage develop very easily into holes during tanning. Grades of skins may be described as follows:

1st Grade

1st grade skins should be from healthy animals, properly slaughtered and prepared, free from fat, flesh and contamination, without blemish.

Any marks, cuts, holes, disease marks, hairslip, putrefaction, water, smoke or insect damage, or bad preparation, degrade the skin.

2nd Grade

2nd grade skins as 1st grade, but showing very slight damage to one side only.

3rd Grade

3rd grade may show two of the following blemishes simultaneously:

- small brands;
- cuts and holes on the bellies;
- slight putrefaction or hairslip, also affecting bellies only;
- slight smoke, water or insect damage on the edge;

There may be pox marks all over the body.

4th Grade

4th grade skins are all those below 3rd grade.

Rejects

Rejects are skins weighing less than 230g taken from immature animals, and those showing extensive damage of any kind on their central part, rendering them unsuitable for tanning. Rejects may be split and sold for glue stock.

Although skins are sold per piece, their weight is taken into consideration during grading, especially in the case of goat skins.

In principle, a 1st grade skin should weigh 450g or more, a 2nd grade not less than 340g, a 3rd grade not less than 300g and a 4th grade not under 230g.

In practice, a skin without blemish and of good substance, may receive a better grade, even if it is lighter and smaller in size than average.

Salting
(Section 149)

Although in some countries hides are still air dried, curing by the use of salt will undoubtedly be more commonly practiced as the meat industry develops.

Hides may be "wet salted", "brined" and "quick dry salted". The third method may, in certain cases, be applied in areas of extensive cattle production.

Quick Dry Salting

As soon as the hide (or skin) has been flayed, and if possible washed, salt in the approximate proportion of 9 kg of salt per cattle hide or large game hide and 2.5 kg of salt per goat or small game skin, is applied.

The salt is rubbed thoroughly into the flesh side.

The hide or skin is then folded flesh side in, as follows:

> two lengthwise folds are made, bringing the bellies toward the centre, then the hide is folded along the backbone, so that the brine resulting from the salt cannot run out.

The folded hide is rolled up like a blanket and placed under a heavy weight for two days.

After this it is hung up over a wire or a frame to dry.

This method is very useful during the rainy season or in humid climates.

By-Products
(Section 150)

No matter how small the hide trimmings may be, they can be converted into glue. Glue stock should be treated against insect damage and deterioration as already described. It is packed in boxes or barrels for despatch to the glue factories.

Tail switches are also of value, and can always be marketed after being thoroughly washed, dried and treated with insecticide. They can be conveniently made up into bundles of 24.

Trimmings, bones, hooves, horns, blood and rumenal contents are all the by-products of slaughter, and can be made use of.

Tools and Equipment - Flaying Knives
(Section 151)

Flaying knives have already been described (see Fig. 65). These knives should always be kept very sharp for which purpose a carborundum stone should be used.

Draining racks should always be built at hide sheds where large numbers of hides are handled. Hides may be:

(a) drained on them after washing;

(b) dried on them after arsenication;

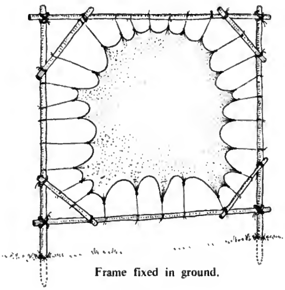
(c) stretched on them while others are being fleshed and washed.

A draining rack consists of four posts dug into the ground on a rectangular plan of 3 m and connected 1.5 m above ground by two crossbars the length of which depends on the number of hides to be hung up.

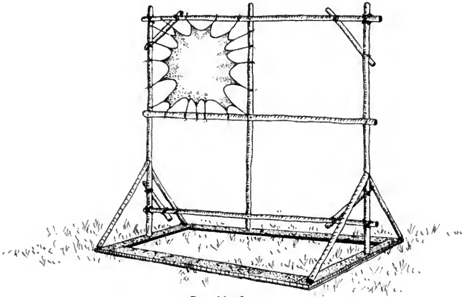
The crossbars are usually 1.8 m long, galvanized wires being laid across them 30 cm apart. The wires must be kept taut to prevent sagging when the hides are put on them.

Fig 66 - FRAMES FOR SUSPENSION DRYING OF HIDES AND SKINS.

(See section 152)



Frame fixed in ground.



Portable frame.

Fleshing tables must be well constructed and have a smooth, even surface. All edges must be rounded. The dimensions of a table should be about 3 m long, by 1 m wide, by 90 cm high.

Frames
(Section 152)

Large frames should always be built as their size can easily be modified by vertical or horizontal poles tied to them.

Where exotic breeds of cattle or the larger Zebu cattle are slaughtered, frames should be 2.8 m X 3.0 m.

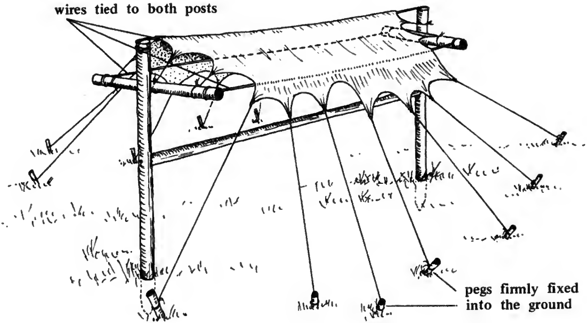
Any wood is suitable provided it is stripped of its bark. These frames can be divided into four with poles and used for calf, sheep and goat skins.

The frames may be suspended from trees or given a permanent support (see Fig. 66).

Frames should be placed in an east-west direction and should not deviate from the vertical by more than 23°.

They should be so placed that the hide is flesh side up.

Fig 67 - WIRE RACK DRYING. (See section 154)



Multiframes
(Section 153)

A good open-air hide shed can be built by erecting a series of frames at about 60 cm from each other with the upright poles firmly dug in the ground.

The frames can be connected by horizontal poles laid along the top and also at about 90 cm from the ground.

It is best to build such a shed in the shade. It is most useful in the drier areas and should be protected from vermin.

Wire Rack Drying
(Section 154)

Another simple method of drying hides is by stretching them over a wire rack. This consists of two uprights 1.5 m tall, placed about 3.0 m from each other (see Fig. 67).

At 30 cm from their top, two 60 cm long pieces of wood are fixed which are connected with each other by two tightly stretched wires. Another wire connects the tops of the two uprights. To keep these vertical a horizontal pole is fixed between them at about 75 cm from ground level.

The hide is laid across the top wire along the centre of the back, flesh side up, and is stretched by means of laces pegged into the ground.

The head and tail are well stretched and fastened to the cross poles and uprights nearest to them.

Light hides may be allowed to hang without being pegged, provided all folds are stretched by means of small sticks.

Sheep and goat skins may even be successfully dried on one wire only, as long as air is allowed to circulate freely between the two sides of the skin and all folds are stretched by the use of small, light sticks.

Tent or Parasol Drying

(Section 155)

This method is very simple and is recommended for nomadic tribes and in areas where timber is scarce.

All that is required are two uprights, one central stick about 75 cm long and 2.5 cm in diameter, about 32 pegs 45 cm long, two hide strips 25 cm long and 32 laces.

The central peg supports the hump of the hide and also is the crossing point of the two hide strips which are laid across its top tautly stretched and fastened to four outer pegs at about 30 cm from ground level.

The hide is laid on these strips, flesh side up, and evenly stretched by means of short laces to the other 28 pegs.

This arrangement forms a kind of an umbrella or tent because of the difference in height between the central and the outer pegs, and the slope of the hide strips.

The umbrella or tent shape will thus shed any rainwater which may fall on the hide.

GLOSSARY

This Manual has been prepared with as few technical and scientific words as possible. When they have had to be used an explanation is generally given of their meaning.

This short Glossary contains, therefore, those words not adequately defined in the text.

Asphyxia	Suffocation; inadequate oxygen in the blood
Asphyxiation	The act of causing asphyxia
Braxy	An acute and fatal toxaemia of sheep due to infection of the abomasum by a clostridial organism (C. Septicum)
Calcified	Accumulation of lime salts in tissue or cells
Celsius	The international name for the centigrade scale of temperature
Eczema	Inflammation of skin with formation of vesicles and crusts with watery discharge
Fahrenheit	The scale of temperature named after a German scientist
Fermentation	Process of change in a substance resulting from presence of a ferment causing rising up (as in bread making); production of heat, etc.
Genus	A group of animals (or plants) having common characteristics distinct from all other groups

Horn button	A button like projection from the head of many mammals from which a horn develops
Jaundice	Yellowness of skin, eyes, tendons resulting from bile in the blood
Lesions	A change in tissues or organs resulting from disease or injury
Mucopurulent	Containing pus and mucus
Opacity	an area not transparent and not penetrable to sight - often a lesion in eye greyish white in appearance
Papule	A pimple
Prophylaxis	Prevention
Prophylactically	Used to prevent
Pustule	Small abscess
Prostrated	Extreme exhaustion
Relapse	The return of disease after apparent recovery
Sand-fly	A midge
Secondary infection	Infection arising from organisms other than the original organisms
Strip Cup	Small cup used for examining milk before milking to check for mastitis or any other defect in the milk
Serous	The fluid part of blood which has been coagulated

Vacuum blood tube	Tube with vacuum to draw blood aseptically used instead of a syringe
Vesicles	Small blister like prominences
Virulence	In case of disease extremely harmful

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Table of Useful Weights and Measures and their Equivalents

Linear and Area Measurements

1 centimeter (cm) = 0.3937 inches
100 centimeters (cm) = 1 meter
100 centimeters (cm) = 3.28 feet
100 centimeters (cm) = 1.094 yards
100 centimeters (cm) = 39.37 inches
1 inch (in) = 25.4 millimeter = 2.54cm
1 foot = 0.3048 m
1 yard (yd) = 3 feet
1 yard (yd) = 0.914 meter
1 rod = 5.5 yards
1 rod = 16.5 feet
1 rod = 25 links
1 mile = 5,280 feet
1 mile = 1,760 yards
1 mile = 1,609.35 meters
1 mile = 320 rods
1 mile = 1/3 leagues
1 mile = 8 furlongs = 80 chains
1 kilometer (km) = 1,000 meters
1 kilometer (km) = 0.621 miles
1 kilometer (km) = 3,280 feet
1 square foot (sq ft) = 144 square inches
1 square foot (sq ft) = 0.111 square yards
1 square foot (sq ft) = 929 square centimeters
1 square yard (sq yd) = 9 square feet
1 square yard (sq yd) = 1,296 square inches
1 square yard (sq yd) = 0.8361 square meters
1 square meter (sq m) = 1,550 square inches
1 square meter (sq m) = 10.764 square feet
1 square meter (sq m) = 1.196 square yards

1 acre (ac) = 43,560 square feet
1 acre (ac) = 4,840 square yards
1 acre (ac) = 0.4047 hectare (ha)
1 acre (ac) = 1 strip 8.25 feet wide by 1 mile long
1 hectare (ha) = 2.471 acres
1 hectare (ha) = 10,000 square meters
1 square mile = 640 acres
1 square mile = 2.59 square kilometers
1 square mile = 259 hectares
1 square kilometer (sq km) = 0.4059 square miles
1 square kilometer (sq km) = 11,318,400 sq ft

Weights and Dry Measures

1 gram (g) = 1,000 milligrams (mg)
1 gram (g) = 0.035 ounce (oz)
1 gram (g) = 15.432 grains
1 ounce (oz) = 28.35 grams
1 ounce (oz) = 437.5 grains
1 pound (lb) = 16 ounces
1 pound (lb) = 453.59 grams
1 pound (lb) = 7,000 grains
1 kilogram (kg) = 1,000 kilograms (kg)
1 kilogram (kg) = 2.2046 pounds
1 cubic centimeter (cc)= 1 milliliter (1 ml)
1 cubic centimeter (cc)= 0.61 cubic inches
1 cubic foot (cu ft) = 0.031 cubic yards
1 cubic foot (cu ft) = 25.71 quarts (qt)
1 cubic foot (cu ft) = 1,728 cubic inches
1 cubic foot (cu ft) = 7.48 gallons
1 cubic foot (cu ft) = 0.0283 cubic meters
1 cubic yard (cu yd) = 27 cubic feet
1 cubic yard (cu yd) = 202 gallons
1 cubic yard (cu yd) = 0.7646 cubic meters
1 cubic meter (cu m) = 1.3079 cubic yards
1 cubic meter (cu m) = 35.314 cubic feet
1 ton (short) = 2,000 pounds (lbs)
1 ton (long) = 2,240 pounds (lbs)

1 metric ton (mt) = 1,000 kilograms (kg)
1 metric ton short (mt) = 1.1023 short ton
1 metric ton long (mt) = 0.9842 long ton
1 short ton = 0.9072 metric ton
1 long ton = 1.0161 metric ton

Volume and Liquid Measures

1 teaspoon (tsp) = 0.17 fluid oz. (fl oz)
1 teaspoon (tsp) = 4.95 milliliters (ml)
1 teaspoon (tsp) = 4.95 cubic centimeters
1 milliliter (ml) = 0.0338 fluid ounces
1 milliliter (ml) = 0.0021 pint
1 milliliter (ml) = 0.001 liter
1 milliliter (ml) = 0.2 teaspoon
1 cubic centimeter (cc) = 0.0338 fluid ounces
1 cubic centimeter (cc) = 0.0021 pint
1 cubic centimeter (cc) = 0.001 liter
1 cubic centimeter (cc) = 0.2 teaspoon
1 tablespoon (tbsp) = 3 teaspoons
1 tablespoon (tbsp) = 14.8 milliliters
1 tablespoon (tbsp) = 14.8 cubic centimeters
1 tablespoon (tbsp) = 0.5 fluid ounce
1 tablespoon (tbsp) = 0.902 cubic inches
1 tablespoon (tbsp) = 0.063 cup
1 fluid ounce (fl oz) = 2 tablespoons
1 fluid ounce (fl oz) = 6 teaspoons
1 fluid ounce (fl oz) = 29.57 milliliters
1 fluid ounce (fl oz) = 29.57 cubic centimeters
1 fluid ounce (fl oz) = 0.125 cup
1 fluid ounce (fl oz) = 1.805 cubic inches
1 cup = 16 tablespoons
1 cup = 48 teaspoons
1 cup = 8 fluid ounces
1 cup = 236.6 milliliters
1 cup = 236.6 cubic centimeters
1 cup = 0.5 pint
1 pint (pt) = 16 fluid ounces
1 pint (pt) = 473.2 milliliters

1 pint (pt) = 473.2 cubic centimeters
1 pint (pt) = 1.04 pounds
1 pint (pt) = 28.37 cubic inches
1 pint (pt) = 0.4732 liters
1 pint (pt) = 32 tablespoons
1 pint (pt) = 2 cups
1 pint (pt) = 0.125 gallon
1 quart (qt) = 0.25 gallon
1 quart (qt) = 2 pints
1 quart (qt) = 4 cups
1 quart (qt) = 32 fluid ounces
1 quart (qt) = 64 tablespoons
1 quart (qt) = 57.75 cubic inches
1 quart (qt) = 946.3 milliliters
1 quart (qt) = 946.3 cubic centimeters
1 liter (l) = 1,000 milliliters
1 liter (l) = 1,000 cubic centimeters
1 liter (l) = 0.264 gallon (US)
1 Liter (l) = 2 64 pint
1 Liter (l) = 33.814 fluid ounces
1 Liter (l) = 61.02 cubic inches
1 Liter (l) = 0.035 cubic foot
1 U.S. gallon (gal) = 3.785 liters
1 U.S. gallon (gal) = 4 quarts
1 U.S. gallon (gal) = 8 pints
1 U.S. gallon (gal) = 128 fluid ounces
1 U.S. gallon (gal) = 16 cups
1 U.S. gallon (gal) = 0.134 cubic foot
1 U.S. gallon (gal) = 0.83 British gallon
1 U.S. gallon (gal) = 3,785.3 milliliters
1 U.S. gallon (gal) = 3,785.3 cub. centimeters
1 U.S. gallon (gal) = 231 cubic inches
1 U.S. gallon (gal) = 8.3358 pounds of water
1 cubic foot of water = 62.2 pounds
1 pound of water = 27.68 cubic inches
1 pound of water = 0.016 cubic foot
1 acre-inch (acre-in) of water = 27,154 gallons
1 acre-inch (acre-in) of water = 624.23 gal.per 100 sq ft

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Miscellaneous Equivalents

1 gram per liter or kg = 0.0083 lb per U.S. gall.
1 gram per liter or kg = 1,000 parts per million
1 part per million = 1 mg per liter or kg
1 part per million(ppm) = 0.0001 percent (%)
1 part per million(ppm) = 0.013 oz by weight
1 part per million(ppm) = 0.379 g in 100 gallons
1 percent (%) = 10,000 parts per million
1 percent (%) = 10 grams per liter
1 percent (%) = 1.28 oz by wt per gall.
1 percent (%) = 8.336 lb per 100 gall.

Temperature Units

C° Centigrade
F° Fahrenheit

C	F
50	122
45	113
44	111.2
43.5	110.3
43	109.4
42.5	108.5
42	107.6
41.9	107.42
41.8	107.28
41.7	107.06
41.6	106.88
41.5	106.70
41.4	106.52
41.3	106.34
41.2	106.16
41.1	105.98
41	105.80
40.9	105.62
40.8	105.44
40.7	105.26
40.6	105.08
40.5	104.9
40.4	104.72
40.3	104.54
40.2	104.36
40.1	104.18
40	104
39.9	103.82
39.8	103.64
39.7	103.46

Temperature Units

C° Centigrade
F° Fahrenheit

C	F
39.6	103.28
39.5	103.10
39.4	102.92
39.3	102.74
39.2	102.56
39.1	102.38
39	102.20
38.9	102.02
38.8	101.84
38.7	101.66
38.6	101.48
38.5	101.30
38.4	101.12
38.3	100.94
38.2	100.76
38.1	100.58
38.0	100.40
37.9	100.22
37.8	100.04
37.7	99.86
37.6	99.68
37.5	99.50
37.4	99.32
37.3	99.14
37.2	98.96
37.1	98.78
37.0	98.60
36.9	98.42
36.8	98.24
36.7	98.06

Temperature Units

C° Centigrade
F° Fahrenheit

C	F
36.6	97.88
36.5	97.70
36.4	97.52
36.3	97.34
36.2	97.16
36.1	96.98
36	96.8
35	95
34	93.2
33	91.4
32	89.6
31	87.8
30	86
25	77
20	68
15	59
10	50
5	41
0	32
-5	23

APPENDIX 3

Normal Rectal Temperatures of Domestic Animals

	Celsius	0° Scales	Fahrenheit
Calf	39.5		103.1
Calf over 1 year	38.5		101.3
Buffalo	38.2		100.8
Camel	36.8		98.2
Lamb	39.5		103.1
Sheep over 1 year	39.5		103.1
Kid	39.8		103.6
Goat Adult	40		104
Piglet	39.8		103.6
Pig Adult	39		102.2
Rabbit	39.3		102.7
Horse	38		101
Fowl	42		107.6

APPENDIX 4

Respiration and Pulse Rates of Healthy Resting Animals

	Respiration Rate	Pulse Rate per Minute
Calf (few days old)	56	116 - 141
Calf (1 month old)	37	105
Calf (6 months old)	30	96
Cattle (young up to 1 yr)	27	91
Cow (adult)	(	40 - 60
Ox (adult)	(12 - 16	35 - 70
Lamb	15 - 18	115
Sheep (yearling)	12 - 20	85 - 95
Sheep (adult)	12 - 15	70 - 80
Sheep (old)	9 - 12	55 - 60
Ram	9 - 12	68 - 81
Kid	12 - 20	100 - 120
Goat (yearling)	12 - 20	80 - 110
Goat (adult)	12 - 15	70 - 80
Billy goat	10 - 15	70
Piglets (up to 2 weeks)	20 - 30	138
Porkers (12 - 14 weeks)	15 - 20	112
Pig (boar)	10 - 20	63 - 68
Pig (sow)	10 - 20	88 - 92
Rabbit	50 - 60	120 - 150
Camel	5 - 12	30 - 50
Fowl	20 - 50	120 - 160

Note: Respiration and pulse rates vary widely in normal healthy animals under the influence of excitement, stress, heat, exercise, etc.

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APPENDIX 5

Oestrus in Domestic Animals

	Age at first Oestrus	Age best to breed from	Length of Oestrus	Occurrence after Parturition	Oestrus cycle if animal not served	Best time to serve
Cattle	10-12 mos(15)	Bull: 1.5-1.75 yrs Heifer: 1.5-2 yrs	0.5-2 days	60-90 days	every 20-22 days	0-16 hrs
Sheep	8-12 mos(9)	In first year	1-2 days	17 days in Autumn	Every 17 days	Second day
Goats	8-12 mos(9)	After 9th month	1-3 days	In Autumn	Every 7-21 days	Second day
Pigs	5- 9 mos(7)	Boar : gilt 10 - 14 mos.	1-3 days	5-7 days after weaning piglets	Every 3-4 weeks	Second day
Rabbit	3- 4 mos	Female: 8-10 mos			All year round	After parturition
Camel	3 years	4 years			Early in year	

Duration of Pregnancy in Domestic Animals

	Period (days)	No. of young
Cattle	274-291 (280)	1
Buffalo (swamp)	312-343 (332)	1
Buffalo (river)	308-317	1
Sheep	140-160 (150)	1 often 2
Goats	146-157 (150)	2
Pigs	110-116 (113)	8 - 12
Rabbit	28- 33 (30)	1 - 12
Camel	410	1
Llama/Alpaca/Vicuna	335-350 (340)	1
Horse	340	1

APPENDIX 7

Suckling Period in Domestic Animals

	Period (weeks)
Cattle (Calf for breeding)	8 - 10
Cattle (Calf for veal)	4 - 6
Sheep (lamb)	6 - 12
Goats (kid female)	4 - 6-8
Goats (kid male)	12
Pigs (for breeding)	8 - 10
Pigs (for fattening)	3 - 4
Rabbit	8

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APPENDIX 8

Dead Carcase Weight and Composition
(Dressing out Percentage)

	Carcase Weight * as Percentage of Live Weight		Percentage Loss of Weight after 70 hours	Percentage of		
	Warm	Cold (After 70 hrs)		Meat	Bones	Skin and Tendons
Cow	47	44	3	64.5	32.7	2.8
Heifer	53	49	4	77.5	21.5	1.0
Ox	55	51	4	70.2	28.3	1.5
Calf	67	64	3	69.5	29.7	0.8
Sheep	50	44	6	69.0	31.0	-
Pig	81	77	4	70.5	21.5	8.0

* Carcase weights and dressing out percentages vary within breeds of cattle, sheep and pigs and between fat and lean animals.

APPENDIX 9

Estimating Live Weight

Using a measuring tape just behind the front legs (the "heart-girth") an approximate estimate of an animal's live weight can be made from the following table:

Measurement		Weight of Dairy Breeds		Weight of Beef Breeds	
cm	ins	kg	lbs	kg	lbs
58.5	23	22.7	50	31.8	70
63.5	25	34.2	75	40.8	90
68.5	27	45.5	100	47.6	105
86	34	56.7	125	56.7	125
91.5	36	68	150	68	150
101.5	40	90.7	200	90.7	200
109	43	113.4	250	117.9	260
117	46	136.1	300	145.2	320
124.5	49	158.8	350	170.1	375
129.5	51	181.4	400	192.8	425
137	54	204	450	217.7	480
142	56	226.8	500	244.9	540
147.5	58	249.5	550	263.1	580
150	59	272.2	600	283.5	625

Materials and Specimens to be submitted to Laboratory for Diagnosis

(a) Note to the A.H.A.

The A.H.A. must appreciate that even with a full veterinary training it is difficult to distinguish between many of the diseases of animals in the field. This is partly because the symptoms of quite different diseases may appear similar and also because the same disease may be caused by different strains or types of the same disease organism which react differently to different drugs, or which require different vaccines for their prevention.

Babesiosis, for example, due to B. bovis responds best to acriflavin based drugs but if due to B. bigemina it will respond to a much wider range of more effective drugs. Foot-and-Mouth Disease (FMD) may be due to many different types and sub-types of virus and it is important to determine precisely the type or sub type involved before selection is made of the vaccine to use in controlling the disease. Bacterial strains may be susceptible to certain antibiotics and not to others. There are many other examples.

All such considerations call for very precise scientific analyses which can only be carried out in the laboratory. For this reason the Veterinarian and the A.H.A. depend very heavily on laboratory help.

Proper examination in the laboratory depends upon the correct material being received by it in a suitable condition for the necessary tests. These vary with the disease suspected and the resources available at the laboratory concerned.

The list that follows attempts to set out the principal specimens that should be sent (with the appropriate precautions) for the various diseases which may be suspected and using the means (preservatives, etc.) likely to be available to an A.H.A. in the field. The list is by no means exhaustive and will no doubt be modified in some countries.

The greatest care should always be taken in selecting and sending laboratory specimens. The fact that they deteriorate rapidly under tropical conditions, if not properly prepared, and will arrive at the laboratory in a useless condition, must be kept in mind.

(b) Material and Specimens to be submitted in Respect of Specific Diseases and Disease Conditions

Disease Suspected	Material Required
1. In Any Animal	
Trypanosomiasis (N)	Blood smears (thick and thin) and lymph node smears
Tuberculosis (N)	Smears and slices from affected tissue in formalin; if udder infection is suspected - fresh milk
Anthrax (N)	Blood smears in a clean bottle (Sec 27)
Mange (N)	Deep scrapings (Sec. 70)
Ringworm	Deep scrapings in a clean bottle - plucked hair (Sec. 76)

Disease Suspected	Material Required
Streptothricosis	Skin scrapings in a clean bottle (Sec. 39)
Anaemia	Thin blood smears, faeces sample
Haemorrhagic) septicaemia)	Blood and lymph node smears and from fluid from any swellings and a long bone.
Snakebite)	
Abscesses	Pus from unopened lesion or swab
Mastitis	Fresh milk or/and milk smear
Navel Ill	Fresh navel tissue or whole carcase. Fluid or pus smears from swollen joints
Pneumonia	Fresh lung and lung in 10% formalin
Worms (intestinal)	Faeces fresh on ice or preserved with 10% formalin
Worms (tissue)	Affected part in formalin
Poisoning	See Section 79

2. In Cattle

Heartwater (N)	Brain squash smears, slice of brain in formalin (Sec. 59)
Contagious bovine pleuro-pneumonia(N)	Lung specimens in formalin and glycerine and/or blood for serum. Send both small (1x1x1cm) specimens and a larger marbled section of lung in 10% formalin

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Disease Suspected	Material Required
Rinderpest (N)	No specimen to be taken unless directed by Veterinarian - blood in citrate. Field diagnosis should be made if possible
Foot-and-Mouth Disease	Inform Veterinarian
Actinomycosis	Fresh pus and pus smears - affected tissue in 10% formalin
East Coat fever (N)	Blood, spleen and lymph node smears
Turning-sickness	Blood, spleen, lymph node and brain squash smears (Sec. 61)
Anaplasmosis	Blood smears
Babesiosis (Red Water)	Blood smears - brain smears
Calf diphtheria	Affected tissue in 10% formalin
Johne's disease (N)	Junction of small and large intestine in 10% formalin; smears from this area and from adjacent mesenteric lymph nodes; rectal snippings
Coccidiosis	Junction of small and large intestine in 10% formalin; faeces. Smears of intestinal wall from inflamed areas
Mastitis	Milk (before antibiotic treatment) on ice
Malignant Catarrh(N)	Liver, kidney and brain in formalin; fresh lymph node; blood with anticoagulant
Brucellosis (N)	2 Blood samples for serum (drawn at abortion and 14 days later)

Disease Suspected	Material Required
Paratyphoid and Scours	The sick calf; fresh liver and mesenteric lymph node. Fresh faeces or faecal smear
Blackquarter	Dried muscle from swelling; smears from affected muscle

3. In Sheep

Heartwater (N)	Brain smear; brain slice in formalin
Pox (N)	Scabs in clean bottle
Scab (N)	Skin scrapings in clean bottle
Enterotoxaemia) Lamb dysentery) Pulpy-kidney disease)	Intestinal contents in chloroform (0.5 percent) not formalin; smears of small intestine contents (Sec. 86)
Blue tongue) (N) Nairobi sheep) disease	Blood in oxalate, carbolic acid and 50 percent glycerine (O C G)
Rift Valley Fever(N)	Blood with anti-coagulant; liver in 50% glycerine
Lymphadenitis	Fresh pus; pus smears

4. In Pigs

Erysipelas (N)	A sick pig or fresh carcase
African Swine Fever(N)	Blood in O C G; piece of the junction of large and small intestine in 10 % formalin; pieces of spleen and liver in glycerine for virus isolation
Piroplasmosis	Blood smears

Disease Suspected		Material Required
Influenza		Fresh lung; lung in 10% formalin
Hog cholera	(N)	As for African Swine Fever
5. In Horses		
Epizootic lymphangitis	(N)	Pus from unopened lesion and smears
Ulcerative lymphangitis		Pus from unopened lesion and smears
Glanders	(N)	Inform Veterinarian, specimens should not be sent
Abortion		2 blood samples for serum (drawn at abortion and at least 14 days after abortion); unopened foetus
Babesiosis		Blood smears
Horse sickness		Blood in O C G
6. Miscellaneous		
Plant poisoning		Plant remains in stomach. If possible a complete flowering specimen with fruit on it from area grazed, between sheets of newspaper, should be taken to Veterinarian
Mineral poisoning, e.g. arsenic		Symptoms should be reported to Veterinarian - 250g sample contents of abomasum and same weight of abomasum itself; also specimens of spleen and liver should be sent

Whichever disease is suspected 2 thin blood smears should always be sent.

All specimens should be plainly identified and be accompanied by a case history, post-mortem details, etc.

Material in formalin should not be more than 1 cm thick slices or the formalin will not be able to penetrate it.

(N) = Notifiable disease in many countries

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List of Equipment Required for Preparing Specimens

Glass microscope

Folders for wrapping slides and recording name and address of recipient

Sterile swabs

Bottles and corked tubes

Jars containing 10 percent formalin

Jars containing 50 percent glycerine (buffered)

Bottles containing citrate or O C G

Jars with chloroform for enterotoxaemia diagnosis would be obtained from Veterinarian

Formalin kills bacteria, viruses, worms and insects and preserves tissues

Glycerine kills most bacteria but preserves viruses

Citrate and oxalate prevent clotting of blood but does not preserve it

O C G consisting of oxalate, carbolic acid and 50 percent glycerine, prevents clotting of blood, kills bacteria and preserves certain viruses

Books or paper for recording and writing reports - many countries have special forms for this purpose

Vaccinations for Livestock

1. Cattle

(a) Vaccinations once only

Disease	Age to Vaccinate
Brucellosis (Contagious Abortion)	3-6 months (females only)
Salmonellosis	1-2 weeks
Heartwater	Birth - 1 month
Rinderpest	6 months

(b) Vaccinations requiring repetition

Disease	Age to Vaccinate	Frequency
Anthrax	All animals	Annually
Black-quarter	All cattle 6-36 months old	Annually
Botulism	All animals	Annually
Foot-and-Mouth Disease	All animals	6 months as required
Haemorrhagic septicaemia	All animals	As required and seasonally
Lumpy skin	All animals	As required
Tetanus	All animals	Annually
Rabies	All animals	Annually or as required

Vaccinations for Livestock

2. Sheep and Goats

Disease	Age to Vaccinate	Frequency
Contagious Agalactia	All animals	Once only
Enterotoxaemia	All animals	Annually
Goat Pox	All animals	Once only
Sheep Pox	All animals	Once only
Nairobi Sheep Disease	All animals	Once only
Peste des Petits Ruminants	All animals	Once only
Rift Valley Fever	All animals	Once only

Taking Dip Samples

To ensure that dipping fluid is kept up to strength as recommended by the manufacturer, samples of the fluid have to be taken by the A.H.A. in charge of the dipping tank. This is a very important duty of the A.H.A. and should be carried out in the following way:

(1) Dip Sample 1 - is collected after some 50 head of cattle have been dipped or at the end of dipping when the last animal is leaving.

(2) Dip Sample 2 - is taken after water has been added to the dip to bring it up to the correct level after the cattle have taken some of the fluid out on their bodies and after the fluid has been well stirred.

(3) Each sample is taken in a clean glass bottle holding about 0.5 litre. The bottle is lowered into the dip by a string tied around its neck and immersed at least 30 cms below the surface. When full it is drawn up and tightly corked.

Plastic bottle should not be used as some plastics absorb certain acaricides and false results may be obtained.

Each sample should be clearly marked:

- Sample 1 (or 2)
- Name and address of sender and Dip Tank No.
- Dip acaricide used
- Date of sample

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Both samples should then be sent for testing. If the acaricide is under strength the analysis results will tell the A.H.A. how many litres of dip must be added to each 1000 gallons (= 4546 l) of dip fluid to bring it up to strength.

If the dip sample is overstrength the result will tell the A.H.A. how many litres of water he should add to each 1000 (= 4546 l) gallons of dip fluid in the tank. Having made the adjustment the dip fluid should be well stirred before the animals start dipping.

APPENDIX 14
Page 1

Grading Form for Cattle Hides

Ground-dried .... Humped ....

Suspension-dried .... Humples ....

From Live Animal .... Fallen Hide ....

Damages	Yes	No	Remarks
ON LIVE ANIMALS			
Mechanical -			
Branding	.....	.....	....
Scratches	.....	.....	....
Wounds	.....	.....	....
Whip lashes	.....	.....	....
Tick bites	.....	.....	....
Diseases -			
Ringworm	.....	.....	....
Scabies	.....	.....	....

Demodex			
Streptothricosis			
Pox			
Fevered			
Damages Inflicted during Killing and Flaying -			
Bruises			
Badly Bled			
Bad Shape			
Dragged Grain			
Cuts			
Gouge Marks			
Contamination			
Damages Inflicted during Drying -			
Hairslip			
Putrefaction			
Unevenness			
Distortion			
Vermin			

Damages Inflicted during Storing and Transport -			
Insects	.....	.....	....
Rats	.....	.....	....
Wetting	.....	.....	....
Rubbing	.....	.....	....
Contamination	.....	.....	....
Adulterations	.....	.....	....
Used Hides	.....	.....	....
Smoked Hides	.....	.....	....

Grade .... Weight .... Price per Kg.........

Grade .... Weight ....

Paid .... Date ....

....
Signature of Grader

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